

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

United States Patent and Trademark
Office
(Box PCT)
Crystal Plaza 2
Washington, DC 20231
ÉTATS-UNIS D'AMÉRIQUE

in its capacity as elected Office

Date of mailing: 17 December 1998 (17.12.98)	
International application No.: PCT/FI98/00446	Applicant's or agent's file reference: MH/FI972302
International filing date: 28 May 1998 (28.05.98)	Priority date: 30 May 1997 (30.05.97)
Applicant: ILVESPÄÄ, Heikki et al	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International preliminary Examining Authority on:
08 October 1998 (08.10.98)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was
☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

<p>The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland</p> <p>Facsimile No 41-22) 740.14.35</p>	<p>Authorized officer:</p> <p>J. Zahra</p> <p>Telephone No.: (41-22) 338.83.38</p>
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PATENT COOPERATION TREATY

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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

REC'D 05 OCT 1999

WIPO

PCT

19

Applicant's or agent's file reference MH/FI972302	FOR FURTHER ACTION		See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/FI98/00446	International filing date (day/month/year) 28.05.1998	Priority date (day/month/year) 30.05.1997	
International Patent Classification (IPC) or national classification and IPC ₆ D 21 F 3/00, D 21 F 7/00			
Applicant Valmet Corporation et al			

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 4 sheets, including this cover sheet.

☐ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of _____ sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 08.10.1998	Date of completion of this report 28.09.1999
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. 08-667 72 88	Authorized officer Ulrika Nilsson/ELY Telephone No. 08-782 25 00

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/FI98/00446

I. Basis of the report

1. This report has been drawn on the basis of *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.)*:

☒ the international application as originally filed.

☐ the description, pages _____, as originally filed,
 pages _____, filed with the demand,
 pages _____, filed with the letter of _____,
 pages _____, filed with the letter of _____.

☐ the claims, Nos. _____, as originally filed,
 Nos. _____, as amended under Article 19,
 Nos. _____, filed with the demand,
 Nos. _____, filed with the letter of _____,
 Nos. _____, filed with the letter of _____.

☐ the drawings, sheets/fig _____, as originally filed,
 sheets/fig _____, filed with the demand
 sheets/fig _____, filed with the letter of _____,
 sheets/fig _____, filed with the letter of _____.

2. The amendments have resulted in the cancellation of:

☐ the description, pages _____

☐ the claims, Nos. _____

☐ the drawings, sheets/fig _____

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the supplemental Box (Rule 70.2(c)).

4. Additional observations, if necessary:

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/FI98/00446

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	<u>1-21</u>	YES
	Claims		NO
Inventive step (IS)	Claims	<u>1-21</u>	YES
	Claims		NO
Industrial applicability (IA)	Claims	<u>1-21</u>	YES
	Claims		NO

2. Citations and explanations

The invention relates to a device and a method in the transfer of a paper- or board web in a paper or board machine. In order to avoid the problems of runnability related to an ordinary drying-wire in the drying section a so-called transfer belt is employed, to which the web is affixed by adhesion.

The following documents are cited in the International Search Report:

D1: WO 9714846 A1
D2: US 5 397 438 A
D3: US 5 298 124 A

Document D1 reveals a dryer fabric operable to carry a paper web on one face. The fabric comprises a base substrate that is coated and optionally impregnated with a resin so as to yield a substrate having an impermeable surface on the paper carrying side of the fabric. The paper carrying side of the fabric is smooth and therefore the paper web adheres well to the surface. The invention is focused on a fabric that should provide sufficient sheet restraint properties so that paper shrinkage is small and uniform.

Document D2 relates to a method and a device for reduction and equalisation of transverse shrinkage of paper in single-wire draw in a drying section.

None of the documents cited above disclose the special combination of features defined in the invention comprising a transfer belt to which a web is affixed by the effect of adhesion and which transfer belt is in contact with a press roll of the last press in the press section.

.../...

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/FI98/00446

Supplemental Box

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: V.

Document D3 cited in the Search Report is considered to represent less relevant prior art concerning a papermaking transfer belt.

It is not considered obvious to a person skilled in the art to modify the known transfer devices or methods in the documents cited above so as to arrive at the claimed invention, involving a superior transferring process.

Therefore, the invention according to claims 1-21 is novel, is considered to involve an inventive step and has industrial applicability.

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference MH/FI972302	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/FI98/00446	International filing date (<i>day/month/year</i>) 28.05.1998	Priority date (<i>day/month/year</i>) 30.05.1997
International Patent Classification (IPC) or national classification and IPC ₆ D 21 F 3/00, D 21 F 7/00		
Applicant Valmet Corporation et al		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 4 sheets, including this cover sheet.

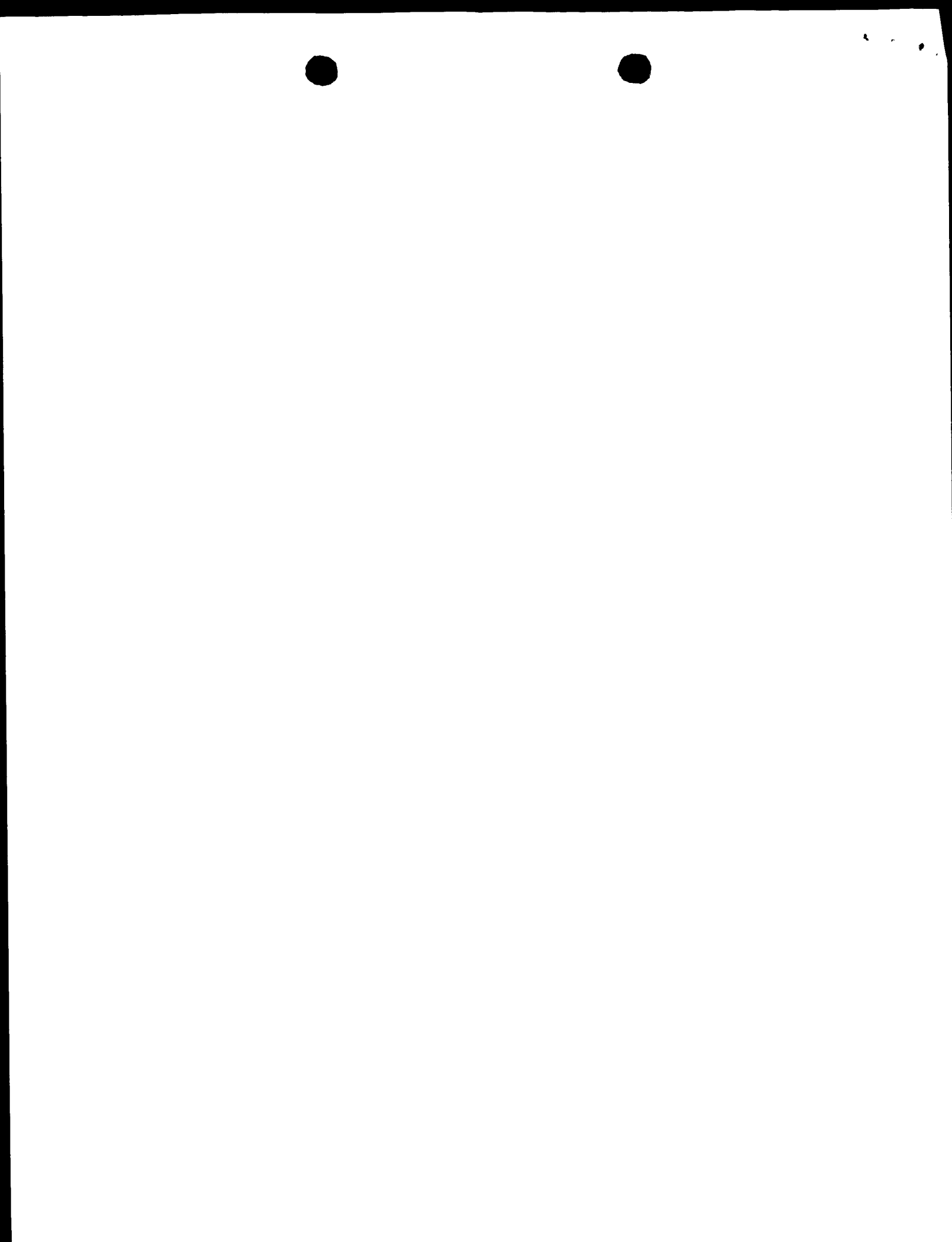
☐ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of _____ sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability, citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 08.10.1998	Date of completion of this report 28.09.1999
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. 08-667 72 88	Authorized officer Ulrika Nilsson/ELY Telephone No. 08-782 25 00



INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/FI98/00446

I. Basis of the report

1. This report has been drawn on the basis of *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.)*:

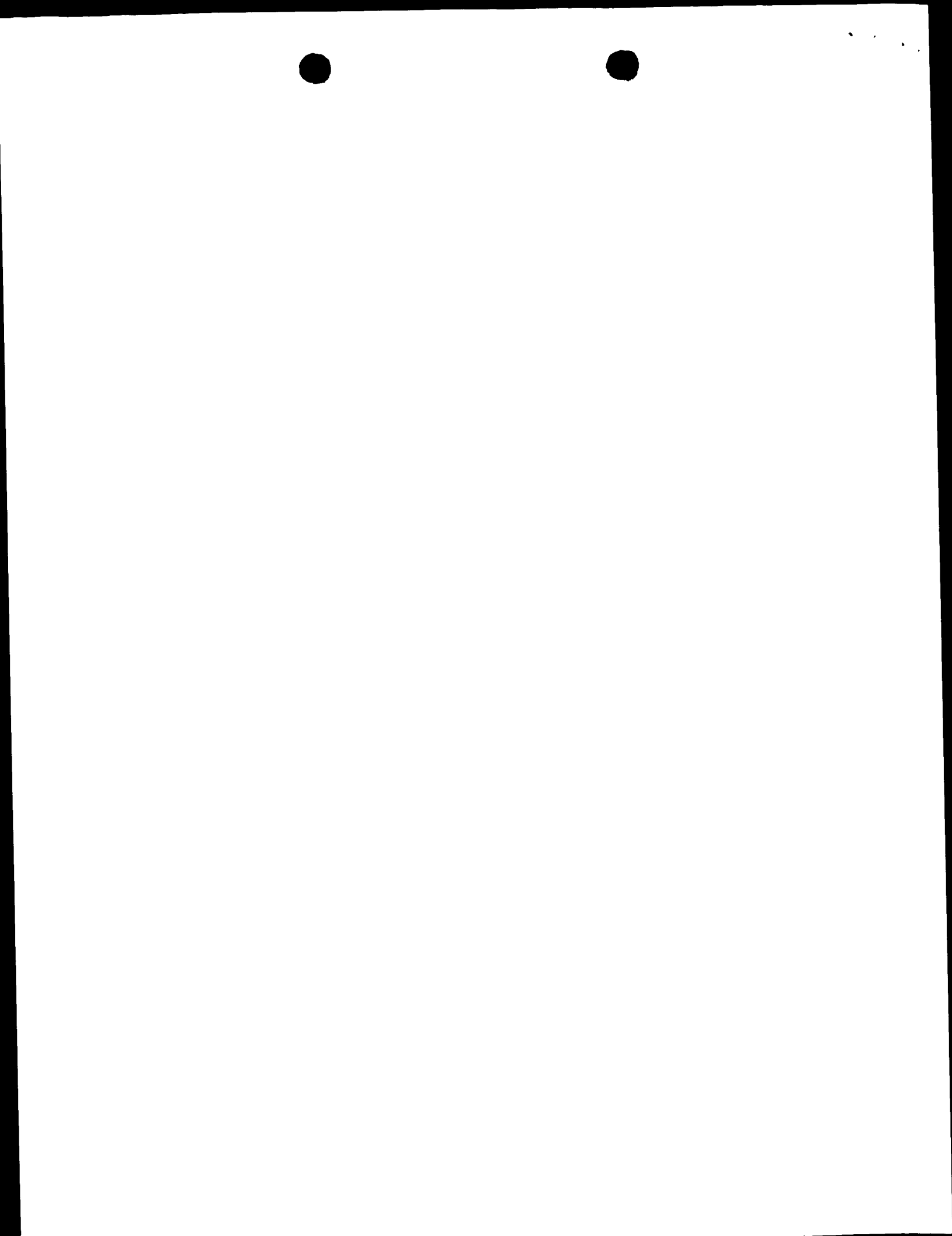
- ☒ the international application as originally filed.
- ☐ the description, pages _____, as originally filed,
 pages _____, filed with the demand,
 pages _____, filed with the letter of _____,
 pages _____, filed with the letter of _____.
- ☐ the claims, Nos. _____, as originally filed,
 Nos. _____, as amended under Article 19,
 Nos. _____, filed with the demand,
 Nos. _____, filed with the letter of _____,
 Nos. _____, filed with the letter of _____.
- ☐ the drawings, sheets/fig _____, as originally filed,
 sheets/fig _____, filed with the demand
 sheets/fig _____, filed with the letter of _____,
 sheets/fig _____, filed with the letter of _____.

2. The amendments have resulted in the cancellation of:

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheets/fig _____

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the supplemental Box (Rule 70.2(c)).

4. Additional observations, if necessary:



INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/FI98/00446

V. Resoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	<u>1-21</u>	YES
	Claims		NO
Inventive step (IS)	Claims	<u>1-21</u>	YES
	Claims		NO
Industrial applicability (IA)	Claims	<u>1-21</u>	YES
	Claims		NO

2. Citations and explanations

The invention relates to a device and a method in the transfer of a paper- or board web in a paper or board machine. In order to avoid the problems of runnability related to an ordinary drying-wire in the drying section a so-called transfer belt is employed, to which the web is affixed by adhesion.

The following documents are cited in the International Search Report:

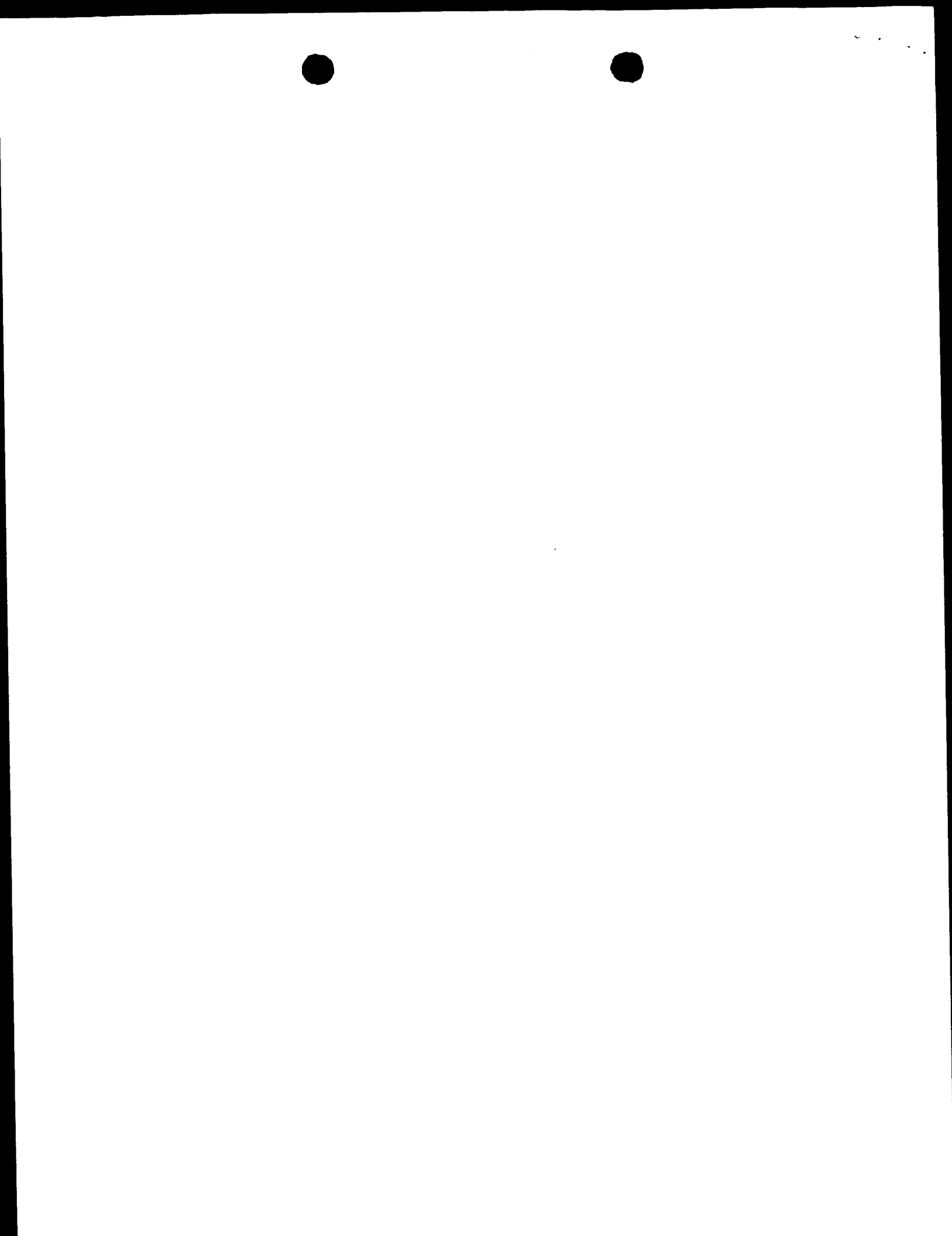
D1: WO 9714846 A1
D2: US 5 397 438 A
D3: US 5 298 124 A

Document D1 reveals a dryer fabric operable to carry a paper web on one face. The fabric comprises a base substrate that is coated and optionally impregnated with a resin so as to yield a substrate having an impermeable surface on the paper carrying side of the fabric. The paper carrying side of the fabric is smooth and therefore the paper web adheres well to the surface. The invention is focused on a fabric that should provide sufficient sheet restraint properties so that paper shrinkage is small and uniform.

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None of the documents cited above disclose the special combination of features defined in the invention comprising a transfer belt to which a web is affixed by the effect of adhesion and which transfer belt is in contact with a press roll of the last press in the press section.

.../...



INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/FI98/00446

Supplemental Box

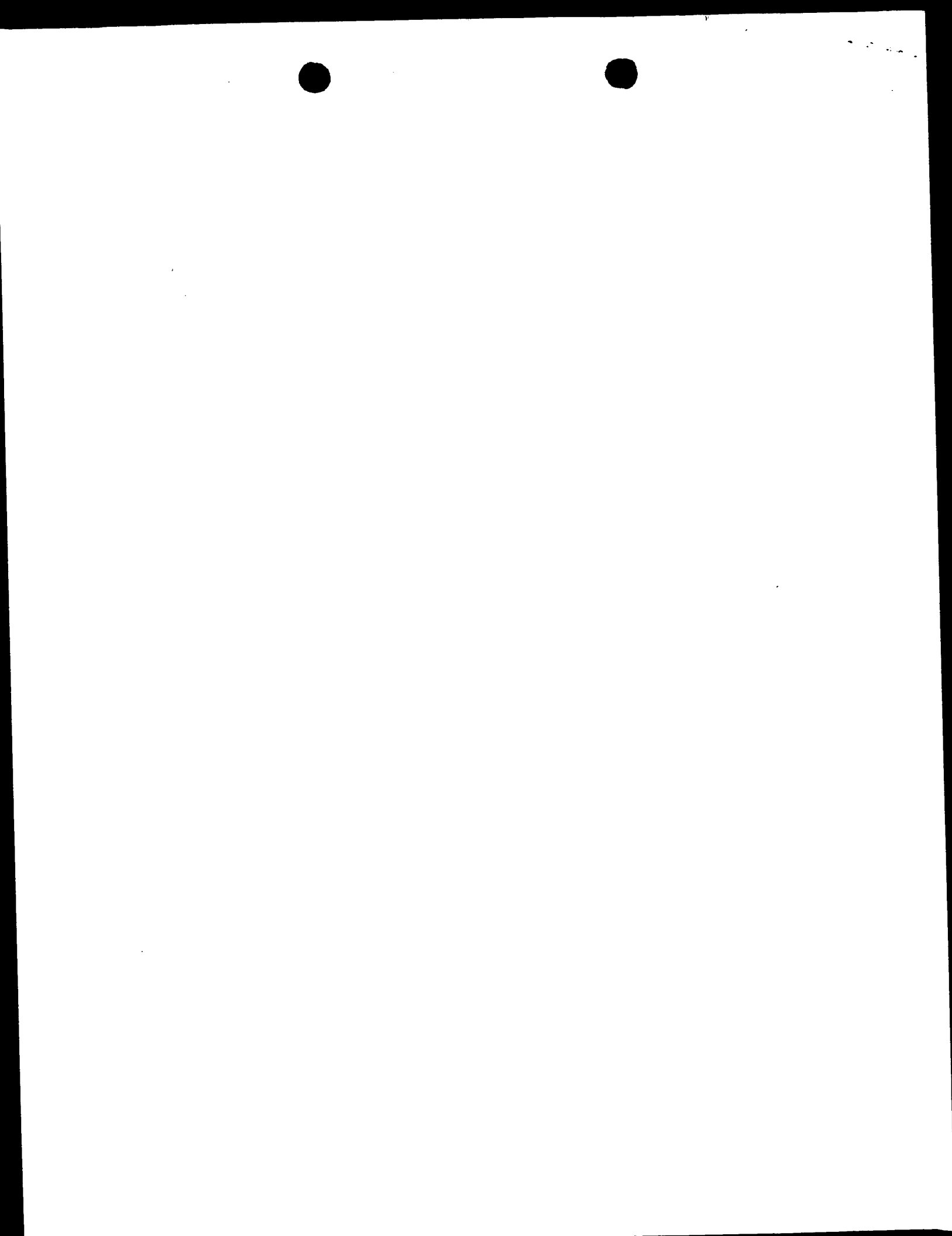
(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: V.

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Therefore, the invention according to claims 1-21 is novel, is considered to involve an inventive step and has industrial applicability.



RECORD COPY PCT

REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

For receiving Office use only	
PCT/FI 9 8 / 0 0 4 4 6	
International Application No.	
28 MAY 1998 (28.05.98)	
International Filing Date	
The Finnish Patent Office PCT International Application	
Name of receiving Office and "PCT International Application"	
Applicant's or agent's file reference (if desired) (12 characters maximum) MH/FI972302	

Box No. I TITLE OF INVENTION	
Device and method in the transfer of the paper or board web in the paper or board machine	
Box No. II APPLICANT	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (i.e. country) of residence if no State of residence is indicated below.) VALMET CORPORATION Panuntie 6 FIN-00620 HELSINKI Finland	
<input type="checkbox"/> This person is also inventor. Telephone No. Facsimile No. Teleprinter No.	
State (i.e. country) of nationality: Finland	State (i.e. country) of residence: Finland
This person is applicant for the purposes of: <input type="checkbox"/> all designated States <input checked="" type="checkbox"/> all designated States except the United States of America <input type="checkbox"/> the United States of America only <input type="checkbox"/> the States indicated in the Supplemental Box	
Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (i.e. country) of residence if no State of residence is indicated below.) ILVESPÄÄ Heikki Anttoninkatu 26 A 3 FIN-40250 JYVÄSKYLÄ Finland	
This person is: <input type="checkbox"/> applicant only <input checked="" type="checkbox"/> applicant and inventor <input type="checkbox"/> inventor only (If this check-box is marked, do not fill in below.)	
State (i.e. country) of nationality: Finland	State (i.e. country) of residence: Finland
This person is applicant for the purposes of: <input type="checkbox"/> all designated States <input type="checkbox"/> all designated States except the United States of America <input checked="" type="checkbox"/> the United States of America only <input type="checkbox"/> the States indicated in the Supplemental Box	
<input checked="" type="checkbox"/> Further applicants and/or (further) inventors are indicated on a continuation sheet.	
Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE	
The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as: <input checked="" type="checkbox"/> agent <input type="checkbox"/> common representative	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) Forssén & Salomaa Oy Yrjönkatu 30 FIN-00100 Helsinki Finland	
Telephone No. +358 9 615 3500 Facsimile No. +358 9 615 3511 Teleprinter No.	
<input type="checkbox"/> Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.	

Continuation of Box No. III FURTHER APPLICANTS AND/OR (FURTHER) INVENTORS

If none of the following sub-boxes is used, this sheet is not to be included in the request.

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (i.e. country) of residence if no State of residence is indicated below.)

VESTOLA Juhani
Tähtäin 25
FIN-40630 JYVÄSKYLÄ
Finland

This person is:

- ☐ applicant only
☒ applicant and inventor
☐ inventor only (If this check-box is marked, do not fill in below.)

State (i.e. country) of nationality: Finland

State (i.e. country) of residence: Finland

This person is applicant for the purposes of:

- ☐ all designated States ☐ all designated States except the United States of America ☒ the United States of America only ☐ the States indicated in the Supplemental Box

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (i.e. country) of residence if no State of residence is indicated below.)

JUPPI Kari
Hiekkapohjantie 259
FIN-40270 PALOKKA
Finland

This person is:

- ☐ applicant only
☒ applicant and inventor
☐ inventor only (If this check-box is marked, do not fill in below.)

State (i.e. country) of nationality: Finland

State (i.e. country) of residence: Finland

This person is applicant for the purposes of:

- ☐ all designated States ☐ all designated States except the United States of America ☒ the United States of America only ☐ the States indicated in the Supplemental Box

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (i.e. country) of residence if no State of residence is indicated below.)

KOMULAINEN Antti
Tarhiantie 22
FIN-42700 KEURUU
Finland

This person is:

- ☐ applicant only
☒ applicant and inventor
☐ inventor only (If this check-box is marked, do not fill in below.)

State (i.e. country) of nationality: Finland

State (i.e. country) of residence: Finland

This person is applicant for the purposes of:

- ☐ all designated States ☐ all designated States except the United States of America ☒ the United States of America only ☐ the States indicated in the Supplemental Box

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This person is:

- ☐ applicant only
☐ applicant and inventor
☐ inventor only (If this check-box is marked, do not fill in below.)

State (i.e. country) of nationality:

State (i.e. country) of residence:

This person is applicant for the purposes of:

- ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

☐ Further applicants and/or (further) inventors are indicated on another continuation sheet.

Box No.V DESIGNATION OF STATES

The following designations are hereby made under Rule 4.9(a)(mark the applicable check-boxes; at least one must be marked):

Regional Patent

- ☒ **AP ARIPO Patent:** GH Ghana, GM Gambia, KE Kenya, LS Lesotho, MW Malawi, SD Sudan, SZ Swaziland, UG Uganda, ZW Zimbabwe, and any other State which is a Contracting State of the Harare Protocol and of the PCT
- ☒ **EA Eurasian Patent:** AM Armenia, AZ Azerbaijan, BY Belarus, KG Kyrgyzstan, KZ Kazakhstan, MD Republic of Moldova, RU Russian Federation, TJ Tajikistan, TM Turkmenistan, and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT
- ☒ **EP European Patent:** AT Austria, BE Belgium, CH and LI Switzerland and Liechtenstein, DE Germany, DK Denmark, ES Spain, FI Finland, FR France, GB United Kingdom, GR Greece, IE Ireland, IT Italy, LU Luxembourg, MC Monaco, NL Netherlands, PT Portugal, SE Sweden, and any other State which is a Contracting State of the European Patent Convention and of the PCT
- ☒ **OA OAPI Patent:** BF Burkina Faso, BJ Benin, CF Central African Republic, CG Congo, CI Côte d'Ivoire, CM Cameroon, GA Gabon, GN Guinea, ML Mali, MR Mauritania, NE Niger, SN Senegal, TD Chad, TG Togo, and any other State which is a member State of OAPI and a Contracting State of the PCT (if other kind of protection or treatment desired, specify on dotted line)

National Patent (if other kind of protection or treatment desired, specify on dotted line):

- | | |
|--|---|
| <input checked="" type="checkbox"/> AL Albania | <input checked="" type="checkbox"/> LT Lithuania |
| <input checked="" type="checkbox"/> AM Armenia | <input checked="" type="checkbox"/> LU Luxembourg |
| <input checked="" type="checkbox"/> AT Austria and Utility Model | <input checked="" type="checkbox"/> LV Latvia |
| <input checked="" type="checkbox"/> AU Australia | <input checked="" type="checkbox"/> MD Republic of Moldova |
| <input checked="" type="checkbox"/> AZ Azerbaijan | <input checked="" type="checkbox"/> MG Madagascar |
| <input checked="" type="checkbox"/> BA Bosnia and Herzegovina | <input checked="" type="checkbox"/> MK The former Yugoslav Republic of Macedonia |
| <input checked="" type="checkbox"/> BB Barbados | <input checked="" type="checkbox"/> MN Mongolia |
| <input checked="" type="checkbox"/> BG Bulgaria | <input checked="" type="checkbox"/> MW Malawi |
| <input checked="" type="checkbox"/> BR Brazil | <input checked="" type="checkbox"/> MX Mexico |
| <input checked="" type="checkbox"/> BY Belarus | <input checked="" type="checkbox"/> NO Norway |
| <input checked="" type="checkbox"/> CA Canada | <input checked="" type="checkbox"/> NZ New Zealand |
| <input checked="" type="checkbox"/> CH and LI Switzerland and Liechtenstein | <input checked="" type="checkbox"/> PL Poland |
| <input checked="" type="checkbox"/> CN China | <input checked="" type="checkbox"/> PT Portugal |
| <input checked="" type="checkbox"/> CU Cuba | <input checked="" type="checkbox"/> RO Romania |
| <input checked="" type="checkbox"/> CZ Czech Republic and Utility Model | <input checked="" type="checkbox"/> RU Russian Federation |
| <input checked="" type="checkbox"/> DE Germany and Utility Model | <input checked="" type="checkbox"/> SD Sudan |
| <input checked="" type="checkbox"/> DK Denmark and Utility Model | <input checked="" type="checkbox"/> SE Sweden |
| <input checked="" type="checkbox"/> EE Estonia and Utility Model | <input checked="" type="checkbox"/> SG Singapore |
| <input checked="" type="checkbox"/> ES Spain | <input checked="" type="checkbox"/> SI Slovenia |
| <input checked="" type="checkbox"/> FI Finland and Utility Model | <input checked="" type="checkbox"/> SK Slovakia and utility Model |
| <input checked="" type="checkbox"/> GB United Kingdom | <input checked="" type="checkbox"/> SL Sierra Leone |
| <input checked="" type="checkbox"/> GE Georgia | <input checked="" type="checkbox"/> TJ Tajikistan |
| <input checked="" type="checkbox"/> GH Ghana | <input checked="" type="checkbox"/> TM Turkmenistan |
| <input checked="" type="checkbox"/> GM Gambia | <input checked="" type="checkbox"/> TR Turkey |
| <input checked="" type="checkbox"/> GW Guinea-Bissau | <input checked="" type="checkbox"/> TT Trinidad and Tobago |
| <input checked="" type="checkbox"/> HU Hungary | <input checked="" type="checkbox"/> UA Ukraine |
| <input checked="" type="checkbox"/> ID Indonesia | <input checked="" type="checkbox"/> UG Uganda |
| <input checked="" type="checkbox"/> IL Israel | <input checked="" type="checkbox"/> US United States of America |
| <input checked="" type="checkbox"/> IS Iceland | <input checked="" type="checkbox"/> UZ Uzbekistan |
| <input checked="" type="checkbox"/> JP Japan | <input checked="" type="checkbox"/> VN Viet Nam |
| <input checked="" type="checkbox"/> KE Kenya | <input checked="" type="checkbox"/> YU Yugoslavia |
| <input checked="" type="checkbox"/> KG Kyrgyzstan | <input checked="" type="checkbox"/> ZW Zimbabwe |
| <input checked="" type="checkbox"/> KP Democratic People's Republic of Korea | |
| <input checked="" type="checkbox"/> KR Republic of Korea | |
| <input checked="" type="checkbox"/> KZ Kazakhstan | |
| <input checked="" type="checkbox"/> LC Saint Lucia | |
| <input checked="" type="checkbox"/> LK Sri Lanka | |
| <input checked="" type="checkbox"/> LR Liberia | |
| <input checked="" type="checkbox"/> LS Lesotho | |

Check-boxes reserved for designating States (for the purposes of a national patent) which have become party to the PCT after issuance of this sheet:

- ☐
- ☐
- ☐

In addition to the designations made above, the applicant also makes under Rule 4.9(b) all designations which would be permitted under the PCT except the designation(s) of

The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit. (Confirmation of a designation consists of the filing of a notice specifying that designation and the payment of the designation and confirmation fees. Confirmation must reach the receiving Office within the 15-month time limit.)

Box No. VI PRIORITY CLAIM Further priority claims are indicated in the Supplemental Box ☐

The priority of the following earlier application(s) is hereby claimed:

Country (in which, or for which, the application was filed)	Filing Date (day/month/year)	Application No.	Office of filing (only for regional or international application)
item (1) Finland (FI)	(30-05-97) 30 May 1997	972302	
item (2)			
item (3)			

Mark the following check-box if the certified copy of the earlier application is to be issued by the Office which for the purposes of the present international application is the receiving Office (a fee may be required):

☒ The receiving Office is hereby requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) identified above as item(s): 972302

Box No. VII INTERNATIONAL SEARCHING AUTHORITY

Choice of International Searching Authority (ISA) (If two or more International Searching Authorities are competent to carry out the international search, indicate the Authority chosen; the two-letter code may be used): ISA / SE

Earlier search Fill in where a search (international, international-type or other) by the International Searching Authority has already been carried out or requested and the Authority is now requested to base the international search, to the extent possible, on the results of that earlier search. Identify such search or request either by reference to the relevant application (or the translation thereof) or by reference to the search request:

Country (or regional Office): Date (day/month/year): Number:

Box No. VIII CHECK LIST

This international application contains the following number of sheets:

- 1. request : 4 sheets
- 2. description : 16 sheets
- 3. claims : 6 sheets
- 4. abstract : 1 sheets
- 5. drawings : 12 sheets

Total : 39 sheets

This international application is accompanied by the item(s) marked below:

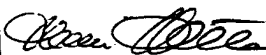
- 1. ☒ separate signed power of attorney
- 2. ☐ copy of general power of attorney
- 3. ☐ statement explaining lack of signature
- 4. ☐ priority document(s) identified in Box No. VI as item(s):
- 5. ☒ fee calculation sheet
- 6. ☐ separate indications concerning deposited microorganisms
- 7. ☐ nucleotide and/or amino acid sequence listing (diskette)
- 8. ☒ other (specify): Official Action

Figure No. 1 of the drawings (if any) should accompany the abstract when it is published.

Box No. IX SIGNATURE OF APPLICANT OR AGENT

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request).

FORSSÉN & SALOMAA OY



Mauri Herttuainen

For receiving Office use only		2. Drawings: <input type="checkbox"/> received: <input type="checkbox"/> not received:
1. Date of actual receipt of the purported international application:	28 MAY 1998 (28-05-1998)	
3. Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application:		
4. Date of timely receipt of the required corrections under PCT Article 11(2):		
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Laitteisto ja menetelmä paperi-/kartonkirainan siirrossa
paperi- tai kartonkikoneessa

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Keksinnön kohteena on laitteisto ja menetelmä paperi-/kartonkirainan siirrossa paperi- tai kartonkikoneessa.

- 10 Rainan kulku kuivatusosan alkupäässä on usein kriittisin vaihe, koska rainan kosteusprosentti on vielä huomattavan suuri ja rainan katkeamisriski on silloin myös suurempi kuin kuivatusosan loppupäässä. Tavanomaisissa yksiviiraviennillä varustetuissa kuivatusosissa onkin siten kuivatusosan ensimmäinen kuivatusryhmä yleensä se kuivatusryhmä, joka määrää koko koneen nopeuden. Näitä ajettavuusongelmia on
- 15 pyritty ennestään minimoimaan siirtymällä ensin kaksiviiraviennistä yksiviiravientiin, kehittämällä erilaisia radan kulkua stabiloivia laitteita, kuten esim. UR-puhalluslaatikot, sekä korvaamalla yksiviiraviennin kääntösynterit imuteloilla, kuten esim. Vac-teloilla. Entistä tehokkaamman tuen aikaansaamiseksi on edelleen nostettu imutelojen alipaineita, mikä tietysti lisää paperikoneen energian kulutusta. Ennestään tunnetusti
- 20 on kuivatusosan alkupään ajettavuusongelmia pyritty myös vähentämään sijoittamalla kuivatusosan alkuun oleellisesti vaakasuora viiravienti, jolla rataa kuivataan puhaltamalla sitä vasten kuumaa ilmaa. Eräänä ongelmana tässä ratkaisussa on päällepuhallusjärjestelyjen viemä tila. Tässä hakemuksessa esitetään ainakin ensimmäisessä kuivatusryhmässä käytettäväksi tavanomaisen kuivatusviiran sijasta ns. siirtohihnaa,
- 25 joka on sellainen rainaa siirtävä belt-elementti, joka on pinnaltaan sileä ja jonka adheesio-ominaisuudet ovat hyvät. Raina tarttuu siirtohihnan pintaan. Lisäksi siirtohihna on ilmaa ja vettä läpäisemätön. Käytettäessä keksinnön mukaista siirtohihnaa ei tarvita erillisiä rainan tukipuhalluksia ja vastaavia, vaan siirtohihna toimii yksin rainaa kuljettavana ja kiinnittävänä elementtinä. Rainan kulku sen ansiosta on
- 30 stabiili. Edellä mainitun rainan kiinnittämisoimaisuuden ansiosta pysyy raina siirtohihnan pinnalla myös kaarevissa rainajuoksissa. Siirtohihnalla varustetussa



yksiviiravientikuivatussylinteriryhmässä ei tarvitse siten käyttää ns. imuteloja kääntösyntereinä.

- 5 Paperikoneen nopeuksien kasvaessa edellä mainitut ajettavuusongelmat etenkin kuivatusosan alussa voimistuvat. Nopeuksien kasvaessa on tullut tarve välttää avoimia radan vientejä myös puristinosan ja kuivatusosan välissä. Ennestään tunnetusti ko. vienti on ehdotettu suljettavaksi mm. poimimalla rata suoraan puristintelan pinnalta imutelan avulla kuivatusviiralle. Ennestään tunnetusti on myös puristinosalla käytetty vettä vastaanottamatonta rataa kasteleamatonta siirtohihnaa, jolta rata on poimittu
- 10 suljettuna vientinä sylinteriryhmän kuivatusviiralle tai suoraan ensimmäisen sylinterin pinnalle. Em. tekniikka ei ole vielä kovin yleistynyt. Eräs potentiaalinen ongelma on rainan siirto siirtohihnalta kuivatusosalle, jota keksinnön eräs suoritusmuoto pyrkii parantamaan.
- 15 Edellä mainittujen ongelmien välttämiseksi keksinnön mukaisessa menetelmässä raina tartutetaan olennaisesti vettä vastaanottamattoman siirtohihnan ulkopinnalle puristinosalla esimerkiksi sen viimeisessä puristinnipissä ja johdetaan suljettuna vientinä kuivatusosalle.
- 20 Keksinnön mukaiseen ratkaisuun kuuluu siten siirtohihnasilmukka, joka on olennaisesti vettä vastaanottamaton ja ulkopinnaltaan paperirainaan adheesiokykyinen ja joka on sovitettu kulkemaan yhtenäisenä lenkinä puristinosan ainakin viimeisen puristimen kautta ja lisäksi kuivatussylinterien kautta. Siirtohihna H₁₀₀ on edullisesti US 5 298 124 patentissa esitettyä tyyppiä.
- 25 Keksinnön mukaisella menetelmällä ja laitekonseptilla voidaan toteuttaa entistä paremmat valmistettavan paperin tai kartongin pintojen sileysominaisuudet ja stabiilimpi rainan kulku, mikä osaltaan perustuu keksinnön mukaisesti sovelletun ja järjestetyn suhteellisen sileäpintaisen siirtohihnan käyttöön.
- 30 Keksintö on käyttökelpoinen nopeuksien edelleen noustessa uusissa koneissa, mutta se tarjoaa myös helpon tavan parantaa olemassa olevien paperikoneiden kuivatusosan

alun ajettavuutta. Olemassa oleva viira korvataan keksinnön mukaisesti siirtohihnalla.

Keksinnölle on tunnusomaista se, mitä on esitetty patenttivaatimuksissa.

- 5 Seuraavassa keksintöä selostetaan yksityiskohtaisesti viittaamalla oheisien piirustuksien kuvioissa esitettyihin keksinnön eräisiin sovellusesimerkkeihin, joiden yksityiskohtiin keksintöä ei ole mitenkään ahtaasti rajoitettu.

10 Kuviossa 1 on esitetty keksinnön mukainen kuivatusosarakenne, joka käsittää tavanomaisen yksiviiraviennin sijasta siirtohihnaviennin, joka edullisesti ulottuu puristimelle asti eli kulkee puristinnipin kautta.

15 Kuviossa 2 on esitetty siirtohihnaviennillä varustettu kuivatusosa, joka käsittää kuivatussylinterien ja kääntötelojen yhteydessä päällepuhallusyksiköt, joiden kautta tuodaan kuivatusväliainetta kuivatustehon lisäämiseksi.

20 Kuviossa 3A on esitetty tekniikan tason mukainen sekä eräässä keksinnön mukaisessa kuivatusosakonseptissa sen toisessa kuivatussynteriryhmässä R_{II} käytetty tavanomainen yksiviiravientijärjestely.

Kuviossa 3B on esitetty keksinnön mukainen ensimmäisessä kuivatussynteriryhmässä R_I käytetty siirtohihnavienti. Kuvion 3B suoritusmuoto vastaa kuviota 2, jossa kuivatussynterien sekä kääntötelojen yhteyteen on asetettu päällepuhallusyksiköt.

25 Kuviossa 4 on esitetty keksinnön suoritusmuoto, jossa raina W johdetaan pitkänippuristimen pitkänippitelan vastatelan pinnan yhteydestä tartuntanipin avulla siirtotelalle ja edelleen kuivatussynteriryhmän keksinnön mukaisen siirtohihnan yhteyteen.

30 Kuviossa 5 on esitetty keksinnön suoritusmuoto, jossa raina johdetaan pitkänippitelan vastatelan pinnalta suoraan siirtohihnan yhteyteen.

Kuviossa 6A on esitetty keksinnön suoritusmuoto, jossa raina johdetaan kuivatusosan ensimmäiseen kuivatussylineriryhmään puristihuovan pinnalta.

5 Kuviossa 6B on esitetty keksinnön suoritusmuoto, jossa raina johdetaan kuivatusosan kuivatussylineriryhmään puristimen keskitelan pinnalta saattamalla siirtohihna kosketuksiin puristimen keskitelan pintaan.

10 Kuviossa 7A on esitetty rainan siirto kuivatussylineriryhmästä R_I sitä seuraavaan kuivatussylineriryhmään R_{II} käyttämällä ryhmien välissä erillistä siirtoimutela ja siirtokudosta.

Kuviossa 7B on esitetty keksinnön suoritusmuoto, jossa kuivatussylineriryhmien R_I ja R_{II} välillä käytetään pelkästään siirtoimutela.

15 Kuviossa 8 on esitetty keksinnön suoritusmuoto, jossa kuivatussylineriryhmän siirtohihna on sovitettu kulkemaan puristinnipin kautta ja jossa ensimmäisessä kuivatussylineriryhmässä R_I sijaitsevat kuivatussylinerit yläpuolisissa asemissa ja kääntötelat alapuolisissa asemissa ja jossa ratkaisussa ensimmäisestä kuivatussylineriryhmästä R_I siirretään raina kaksiviiraviennin käsittävään kuivatussylineriryhmään R_{II} .

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Kuviossa 9A on esitetty keksinnön suoritusmuoto, jossa siirtohihna johdetaan puristinosan viimeiseltä puristimelta puristinnipin kautta niin, että siirtohihnaalenkin sisällä on suurihalkaisijainen tela, jonka pinnan myötäisesti on asetettu kaksi päällepuhallusyksikköä ja niiden päällepuhallushuuvat.

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Kuviossa 9B on esitetty keksinnön suoritusmuoto, joka muuten vastaa kuvion 9A suoritusmuotoa, mutta kuvion suoritusmuodossa sijaitsee ennen ns. päällepuhallustela päällepuhallusyksikkö, jolla suoritetaan rainan esilämmitys ennen varsinaista päällepuhallustela.

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Kuviossa 10 on esitetty muuten kuviota 9A vastaava suoritusmuoto, mutta kuvion suoritusmuodossa ns. päällepuhallustela on korvattu vielä suurempihalkaisijaisella telalla päällepuhallusmatkan lisäämiseksi.

5 Kuviossa 11 on esitetty keksinnön suoritusmuoto, jossa ns. päällepuhallustela on korvattu pitkänomaisella päällepuhallushuuvalla. Päällepuhallusyksikkö on asetettu lineaarisen siirtohihnajuoksun yhteyteen ja päällepuhallusyksikön jälkeen raina siirretään siirtohihnalta kuivatusosan ensimmäiseen kuivatussynteriryhmään.

10 Kuviossa 12 on esitetty kuviota 11 muuten vastaava suoritusmuoto, mutta kuvion ratkaisussa päällepuhallusmatkaa on kasvatettu sijoittamalla tukirullat pystysuuntaisesti pinoon, jolloin raina ja siirtohihnajuoksu kulkee ensin tukirullien myötäisesti ylöspäin ja viimeiseltä tukirullalta vastaavien tukirullien myötäisesti alaspäin. Päällepuhallusyksiköt on asetettu tukirullien molemmille puolille.

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Kuviossa 13 on esitetty kuviota 11 muuten vastaava rakenne, mutta suoritusmuodossa kuivatusosan K alku käsittää imulaatikot heti siirtoimutelan jälkeen.

Kuviossa 1 esitetyssä rakenteessa on yksiviiravienti korvattu siirtohihnaviennillä.

20 Kuvion 1 kuivatusosakonseptissa kulkee siirtohihna H_{100} lisäksi paitsi kuivatusosan K ensimmäisen kuivatussynteriryhmän R_1 kautta niin myös puristinosan P kautta. Siirtohihna H_{100} kulkee suljettuna lenkkinä puristimen P_N puristintelojen $10a_1, 10a_2$ välisen nipin N_1 kautta. Keksinnön mukaisessa ratkaisussa kiinnittyy paperi- tai kartonkiraina W kuviossa 1 esitetysti puristimen 10 puristintelojen $10a_1$ ja $10a_2$ välisessä nipissä N_1 puristinnipin N_1 kautta johdettuun siirtohihnaan H_{100} ja kulkee siirtohihnan pinnalla kuivatusosalle K sen ensimmäiselle kuivatussynteriryhmälle R_1 . Siirtohihna H_{100} on siten johdettu puristinosaan P ainakin viimeisen puristimen P_N puristinnipin N_1 kautta. Puristimelle P_N raina johdetaan pick-up-telan 13b imun avulla siten, että raina siirretään ensin siirtohuovalle H_N ja pidetään sen pinnan myötäisesti puhalluslaatikon f aikaansaamalla pitoimulla. Siirtohuopa H_N on viety siten nipin N_1 kautta ja ohjattu huovanohjausteloilla $13a_1, 13a_2 \dots$ Puristin P_N on edullisesti pitkänippipuristin, jonka kuviossa 1 esitetty yläpuolinen tela $10a_1$ on ns.

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pitkänippitela ja käsittää joustavan pitkänippitelan hihnavaipan. Pitkänippitelan $10a_1$ yläpuolinen tela $10a_1$ käsittää kuormituskengän, joka painetaan vastatelaan kohti, jolloin joustava hihnavaippa tulee vastaamaan kuormituskengän määräämää pinta-muotoa. Kuivatusryhmältä R_I siirtyy raina W toiselle kuivatusryhmälle R_{II} , joka on
 5 tavanomainen eli käsittää tavanomaisen yksiviiraviennin tavanomaisine viiroineen H_2 . Viira H_2 on ohjattu suljettuna lenkkinä viiranohjaustelojen $14a_1, 14a_2$ kautta. Koros-tettakoon kuitenkin tässä yhteydessä, että keksintö on käyttökelpoinen myös muiden tunnettujen puristinratkaisujen kuin pitkänippipuristimen yhteydessä. Puristin voi koostua myös edullisesti useammasta kuin yhdestä vettäpoistavasta puristinnipistä.

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Ennestään tunnetuissa puristinosissa käytettyjen puristushuopien merkittävänä epäkohtana on rataa uudelleen kostuttava vaikutus ja likaantumistaipumus. Keksinnön mukainen siirtohihna H_{100} on olennaisesti vettä vastaanottamaton, ilmaa läpäisemä-tön, sileä ja ulkopinnaltaan paperirainaan adheesiokykyinen. Tällöin paperirata on
 15 tartutettavissa siirtohihnasilmukan ulkopintaan ilman, että raina uudelleen kostuu. Siirtohihnalla raina (paperiraina tai kartonkiraina) on johdettavissa suljettuna ja tuettuna vientinä puristimelta kuivatusosalle K kuivatusosan ensimmäiseen kuivatus-ryhmään R_I ja siltä tavanomaiseen yksiviiraviennillä varustettuun kuivatussyylinteri-ryhmään R_{II} , joka käsittää tavanomaiset **VacRoll**-tyyppiset imutelat S_1, S_2, \dots

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Puristintelojen $10a_1$ ja $10a_2$ muodostamasta nipistä N_1 , joka edullisesti on pitkänippi, kuljetetaan raina siirtohihnan H_{100} yläpinnalla ns. esikuivatusosan eli kuivatusosan K ensimmäisen kuivatussyylinteriryhmän R_I ensimmäiselle kuivatussyylinterille K_1 , joka on höyryllä kuumennettu kuivatussyylinteri. Raina W kulkee edelleen kuivatussy-
 25 linterin K_1 pinnan myötäisesti siirtohihnan H_{100} ja kuivatussyylinterin K_1 pinnan välissä eteenpäin tavanomaiselle kääntötölle E_1 ja pysyy siirtohihnan H_{100} pinnassa kiinni myös kääntötelan E_1 yhteydessä, joka on tavanomainen ei-kuumennettu telarakenne. Siirtohihna H_{100} on ohjattu paitsi kuivatussyylinterien K_1, K_2, \dots ja kääntötelojen E_1, E_2 ja nipin N_1 kautta niin myös siirtohihnan ohjaustelojen
 30 $12a_1, 12a_2, \dots, 12a_N$ kautta. Raina W kulkee silmukkamaisesti polveillen kuivatusosa kuivatussyylinteriryhmässä R_I eli kääntöteltalta E_1 edelleen toiselle ryhmän R_I kuu-mennetulle kuivatussyylinterille K_2 ja eteenpäin kuivatussyylinterien ryhmässä R_{II} .

Kääntötelat $E_1, E_2 \dots E_n$ voivat siten kuivatusryhmässä R_I olla tavanomaisia sileäpintaisia teloja. Telat voivat olla myös urapintaisia. Ne eivät tarvitse sisäpuolista imua ja rei'itystä, joiden avulla tavanomaisessa yksiviiraviennillä varustetussa kuivatusosassa kiinnitetään raina W imusylinterien kohdalla viiran pintaan. Siirtohihna H_{100} on ominaisuudeltaan sellainen, että raina W pysyy siirtohihnan pinnassa kiinni myös tavanomaisten ei imulla varustettujen kääntötelojen $E_1, E_2 \dots$ muodostamassa silmukkamaisesta polveilevassa rainajuoksussa. Kuivatussylinterin K_3 yhteydestä raina W siirtyy edelleen toisen kuivatusryhmän R_{II} siirtoimutelalle D_1 . Siirtoimutelan D_1 imun siirtämänä irrotetaan raina W siirtohihnasta H_{100} ja siirretään edelleen siirtohihnan H_{100} pinnan yhteydestä kuivatusosan K toisen kuivatussylinteriryhmän R_{II} viiran H_2 yhteyteen ja edelleen eteenpäin kyseisessä tavanomaisessa kuivatussylinteriryhmässä R_{II} .

Kuivatusosan alussa raina W on heikoimmillaan, koska sen vesipitoisuus on vielä suuri. Kuivatusosan alku on siten yleensä määrännyt sen maksiminopeuden, millä paperi-/kartonkikoneetta on voitu ajaa. Näin ollen ensimmäinen kuivatusryhmä R_I on yleensä määrännyt kuivatusosan ja siten myös koko paperikoneen/kartonkikoneen maksiminopeuden. Käytettäessä siirtohihnaa H_{100} kuivatusosan K ensimmäisessä kuivatussylinteriryhmässä R_I voidaan merkittävästi nostaa koko paperikoneen/kartonkikoneen nopeutta. Käytettäessä siirtohihnaa H_{100} eli belttiä tavanomaisen viiran asemasta pystytään huomattavasti stabiloimaan ja nopeuttamaan rainavientiä kuivatusosan alkupäässä. Siirtohihnaa H_{100} käytettäessä on rainan W kulku stabiili ja vakaa eikä rainan katkeamisvaaraa esiinny. Raina W siirtyy suljettuna vientinä puristimelta kuivatusosalle sen kuivatussylinteriryhmään R_I ja siitä toiseen ryhmän R_{II} . Avoimia rainavientejä ei kuivatusosan K keksinnön mukaisessa ensimmäisessä kuivatussylinteriryhmässä R_I esiinny.

Kuviossa 1 esitetysti johdetaan raina keksinnön mukaiselta esikuivatusosalta eli keksinnön mukaiselta ensimmäiseltä kuivatusryhmältä R_I kuivatusosan toiselle kuivatussylinteriryhmälle R_{II} , joka on tavanomainen yksiviiraviennillä varustettu kuivatussylinteriryhmä, jossa viira on sovitettu kulkemaan tavanomaisten **VacRoll**-tyyppisten imutelojen $S_1, S_2 \dots$ kautta. Imutelat $S_1, S_2 \dots$ käsittävät telavaipan läpi

kulkevan rei'ityksen, joka toisaalta avautuu telan vaippapinnalla oleviin uriin ja toisaalta telan sisäpuolelle, johon kohdistetaan alipaine. Tällöin saadaan imu- ja pitovoima kohdistumaan kehämäisesti telavaipan pinnalla oleviin uriin ja edelleen ulommaisena vietyyn rainaan W. Viira on ilmaa läpäisevä tavanomainen yksiviiraviennissä käytetty kudος. Vaikka kuviossa 1 ryhmä R_{II} on normaali yksiviiravientiryhmä, saattaa joissakin tapauksissa ryhmä R_{II} , etenkin uusinnossa, joita tähdätään nimenomaan kuivatusosan alun ajettavuusongelmien poistamiseen, keksinnön mukaisesti olla myös muunlainen kuivatusryhmä esim. UnoRun-ryhmä tai jopa kaksiviiravientiryhmä.

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Perinteisen sylinterikuivatuksen ensimmäisessä ryhmässä tapahtuu vain hyvin vähän rainassa olevan veden haihtumista viiran läpi. Tästä syystä keksinnön mukaisesti ilmaa ja vettäläpäisemättömän hihnan käyttö ei oleellisesti heikennä kuivatustehoa. Päinvastoin, kun rata luotettavasti seuraa hihnaa, voidaan sylintereiden lämpötilaa nostaa ilman vaaraa, että rata seuraisi sylinterin pintaa. Jos halutaan edelleen lisätä kuivatuskapasiteettia, voidaan käyttää kuvion 2 mukaista järjestelyä.

Kuivatustehon edistämiseksi on kuviossa 2 esitetty kuivatusosan kuivatussyylinteriryhmä R_I varustettu lisäksi kääntösyylinterien $E_1, E_2 \dots$ yhteydessä olevilla päällepuhalluslaatikoilla $11a_1, 11a_2 \dots$, joiden kautta puhalletaan kuumaa ilmaa / kuumaa kaasua / kuumaa höyryä rainan W yhteyteen kuivatustehon parantamiseksi. Kuviossa 2 esitetty kuivatusosarakenne vastaa muuten kuvion 1 kuivatusosarakennetta. Keksinnön mukaisessa laiteratkaisussa voivat päällepuhallusyksiköt sijaita joko pelkästään höyryllä kuumennettujen kuivatussyylinterien yhteydessä tai kuten kuviossa 2 on esitetty ja kääntötelojen $E_1, E_2 \dots$ yhteydessä. Periaatteessa vastaava päällepuhallus voidaan järjestää myös kuivatussyylinterien $K_1, K_2 \dots$ yhteyteen, mutta sen teho jää huonoksi läpäisemättömän hihnan vuoksi.

Kuviossa 3A on esitetty tekniikan tason mukainen ja kuivatussyylinteriryhmässä R_{II} eli toisessa kuivatussyylinteriryhmässä käytetty tavanomainen yksiviiravienti. Tavanomainen kuivatusviira H_2 on johdettu kuivatussyylinteriltä K_1' imutelalle S_1 ja imutelalta S_1 toiselle kuivatussyylinterille K_2' ja eteenpäin kuivatussyylinteriryhmässä

R_{II} . Kuviossa esitetysti imusylinteri S_1 käsittää pinnallaan urituksen u_1, u_2 , joihin päätyvät imusylinterin vaipan S' läpi viedyt reiät a_1, a_2 . Imusylinterin sisälle kohdistetaan alipaine, jolloin saadaan kehämäinen pitovoima kohdistettua rainaan W . Kuvioden 1 ja 2 mukaisesti sylinterien ja imutelan muodostamaan taskuun voidaan
5 sijoittaa myös puhalluslaatikot B_1 ja B_2 tai vastaavat radan kulkua stabiloivat laitteet.

Keksinnön mukainen kuivatusosakonsepti voi käsittää useita kuivatussylinteriryhmiä $R_{II}, R_{III}, R_{IV}, \dots$, jotka kuivatussylinteriryhmät ensimmäisen kuivatussylinteriryhmän
10 jälkeen ovat tavanomaisia yksiviiraviennillä varustettuja kuivatussylinteriryhmiä. Myös siirtohihnaa voidaan käyttää myös muissa kuin ensimmäisessä kuivatussylinteriryhmässä.

Kuviossa 3B on esitetty havainnollisesti aksonometrisesti kuvion 2 mukainen ryhmä
15 R_I , jossa sekä kuivatussylinterit että sileäpintaiset kääntösylinterit on varustettu päällepuhallusyksiköillä $11a_1, 11a_2, \dots$, joiden kautta johdetaan lämmönsiirtoväliainetta, edullisesti höyryä tai kuumaa ilmaa rainan W yhteyteen. Kuviossa esitetysti ovat kääntöteloja E_1, E_2, \dots sileäpintaisia kääntöteloja. Siirtohihna H_{100} on johdettu kääntöteloin E_1, E_2, \dots sileän rei'ittämättömän telapinnan e kautta.

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Seuraavissa kuvioissa 4—8 selostetaan erilaisia rainan siirtotapoja kuivatusosalle K ja kuivatusosan ensimmäisestä kuivatussylinteriryhmästä toiseen kuivatussylinteriryhmään. Olennaista kuitenkin kaikille seuraavassa selostettaville suoritusmuodoille on, että ainakin kuivatussylinteriryhmä R_I on vastaavanlainen siirtohihnalla H_{100}
25 varustettu kuivatussylinteri, kuten on selostettu kuvion 1 yhteydessä.

Kuviossa 4 on esitetty keksinnön suoritusmuoto, jossa kuivatusosan K kuivatussylinteriryhmä R_I muodostuu kuten kuvion 1 suoritusmuodossa kuivatussylintereistä K_1, K_2, K_3 ja kääntösylintereistä E_1, E_2 ja E_3 . Kuivatussylinterit K_1, K_2, K_3 ovat kuten
30 kuvion 1 suoritusmuodossa höyryllä kuumennettuja sileäpintaisia kuivatussylintereitä ja kääntösylinterit E_1, E_2, \dots ovat tavanomaisia sileäpintaisia teloja. Kuviossa esitetyssä suoritusmuodossa kuivatusryhmän R_I ja R_{II} välillä on sileäpintainen tela K_{10} , joka

- voi olla myös sylinteri kuten kuivatussylinteri. Ryhmässä R_I on keksinnön mukaisesti siirtohihnalla H_{100} ja raina W siirtyy kuviossa esitetysti silmukkamaisesti polveillen siirtohihnaan sen adheesiolla kiinnittyneen siirtohihnan H_{100} mukana eteenpäin kuivatussylinteriryhmässä. Kuivatussylinteriryhmään R_I raina siirretään puristimelta
- 5 P_N puristintelojen $10a_1$ ja $10a_2$, edullisesti pitkänippipuristimen telojen yhteydestä. Raina W siirretään kuviossa esitetysti sileäpintaisen pitkänippitelan $10a_1$ yläpuolisen vastatelan $10a_2$ yhteyteen ja sen sileään pintaan kiinnittyneenä eteenpäin ja edelleen tartutanipin V välityksellä yläpuoliselle siirtotelalle S_{100} , esimerkiksi imutelalle ja sen yhteydestä siirtohihnan H_{100} yhteyteen, jonka pintaan raina W on kiinnittyneenä.
- 10 Ryhmästä R_I raina siirretään sylinterin tai sileäpintaisen telan K_{10} yhteyteen ja edelleen toisen kuivatusryhmän R_{II} yhteyteen viiran H_2 ja sylinterin K_{10} väliin ja eteenpäin ryhmässä R_{II} . Ryhmä R_{II} voi olla tavanomainen yksiviiraviennin käsittävä kuivatussylinteriryhmä, joissa kuivatussylinterien välillä on VacRoll-telat S_1, S_2, \dots , kuten kuvion 1 suoritusmuodossakin. Tartutanippi V voi toimia tässä suoritusmuo-
- 15 dossa myös ns. tasauspuristimena, jolla aikaansaadaan oleellisesti sama sileys rainan molemmille pinnoille.

- Kuviossa 5 on esitetty keksinnön suoritusmuoto, jossa kuivatusosan kuivatussylinteriryhmä R_I käsittää siirtohihnan H_{100} kuten edellisissäkin suoritusmuodoissa, mutta
- 20 jossa ratkaisussa raina W poimitaan siirtohihnan H_{100} yhteyteen puristimen P , edullisesti pitkänippipuristimen pitkänippitelan $10a_1$ vastatelan $10a_2$ yhteydestä. Raina W siirtyy puristimen P_N nipin N_1 jälkeen puristimen P_N vastatelan $10a_2$, edullisesti sileäpintaisen telan pinnalla jonkin matkaa, ja tulee mainitun telan pinnan yhteyteen asetetun siirtohihnan H_{100} kanssa kosketukseen ja kiinnittyy siihen. Kuvion suoritusmuodossa ohjaustela $12a_n$ on asetettu siten puristimen P_N alapuolisen telan $10a_2$ yhteyteen, että se painaa siirtohihnan H_{100} kiinni puristimen P_N alatelaan $10a_2$.
- 25 Kuviossa esitetysti raina W kuljetetaan siten siirtohihnan H_{100} mukana silmukkamaisesti polveillen kuivatussylinterien K_1, K_2, \dots ja tavanomaisten sileäpintaisten kääntötelojen E_1, E_2, \dots kautta, kuten kuvion 1 suoritusmuodossa, ryhmässä R_I siirtoimutelalle
- 30 S_{100} , joka sijaitsee ryhmien R_I ja R_{II} välissä ja joka voi käsittää pinnallaan viirasukan, jolloin rainaan W kohdistetaan viirasukan läpi imuvaikutus ryhmien

välisessä positiossa. Raina siirretään siten ryhmästä R_I ryhmään R_{II} , joka voi olla tavanomainen Vac-telat S_1, S_2, \dots käsittävä yksiviiravientikuivatussyylinteriryhmä.

Kuviossa 6A on esitetty keksinnön suoritusmuoto, jossa puristimelta P raina W
 5 johdetaan kuivatusosalle K sen ensimmäiseen kuivatussyylinteriryhmään R_I , joka käsittää edellä selostetun siirtohihnan H_{100} . Kuvion 6A suoritusmuodossa raina W johdetaan siirtohihnan H_{100} kiinnittyneenä kuivatussyylinteriltä K_1 sileäpintaiselle kääntötetalle E_1 ja edelleen toisessa korkeusasemassa olevalle kuivatussyylinterille K_2 ja eteenpäin kuivatussyylinteriryhmässä. Näin ollen siirtohihnan H_{100} pidetään raina
 10 kosketuksessa siirtohihnan pintaan kaikkialla rainan ollessa kiinnittyneenä siirtohihnan adheesion avulla. Näin ollen VacRolleja tai vastaavia ei tarvita eikä tarvita myöskään puhalluslaatikoita ja vastaavia. Puristimelta P_N nipistä N_1 raina W johdetaan puristinhuopien H_N ja H_{N+1} väliin. Raina W siirretään huovalta H_N ryhmän R_I sen siirtohihnalle H_{100} , kuten kuvion 1 suoritusmuodossa ja ryhmästä R_I
 15 ryhmään R_{II} , joka ryhmä R_{II} voi olla kuten kuviossa on esitetty esimerkiksi kaksivii-raryhmä käsittäen viirat H_{200}, H_{201} . Kuivatussyylinteriryhmästä R_I raina siten siirretään esimerkiksi tavanomaiselle kaksiviiraryhmälle R_2 siirtoimutelan D_{10} avulla. Kuivatussyylinteriryhmä R_{II} käsittää siten tavanomaiset viirat H_{200}, H_{201} sekä kuiva-tussyylinterit K_1', K_1'' ja $K_2', K_2'' \dots$

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Kuviossa 6B on esitetty suoritusmuoto, jossa raina siirretään kuivatusosan K ensimmäiseen kuivatussyylinteriryhmään R_I puristinosan P keskitelan 50 yhteydestä. Raina W tuodaan kuviossa esitetysti nipin N_{10} kautta keskitelan 50 yhteyteen ja siirretään keskitelan pinnalla toiseen puristinnippiin N_{20} ja edelleen keskitelan 50 pinnan 50'
 25 myötäisesti puristinnipin N_2 kautta ja edelleen keskitelan 50 pinnalta 50' ryhmän R_I siirtohihnan H_{100} yhteyteen, joka siirtohihna H_{100} on tuotu keskitelan 50 pintaan kiinni telan T avulla. Kuviossa esitetysti voi ryhmä R_{II} olla esimerkiksi kaksiviiravientiryhmä tai kuten kuviossa 1 on esitetty tavanomainen yksiviiravientiryhmä. Ryhmä R_I on samanlainen kuin on ryhmä R_I kuviossa 1. Ryhmä R_{II} on vastaavanlainen kuin on esitetty kuvion 6A suoritusmuodossa. On selvää, että ryhmä voi olla
 30 myös tavanomainen yksiviirakuivatussyylinteriryhmä. Puristimen P huopavientejä on merkitty H_{n+2} ja H_{n+3} .

Kuviossa 7A on esitetty ryhmien R_I ja R_{II} välillä oleva erillinen siirtokudoslenkki H_{300} , joka on viety imutelan S_{200} kautta, joka imutela S_{200} sijaitsee ryhmien R_I, R_{II} välissä. Raina W siirretään ryhmän R_I siirtohihnan H_{100} yhteydestä siirtoviiran H_3 yhteyteen ja edelleen toiseen kuivatusryhmään R_{II} . Kuvion suoritusmuodossa ryhmä

5 R_I käsittää siirtohihan H_{100} sileäpintaiset kääntösynterit E_1 ja E_2 sekä kuivatussynterit K_1, K_2, \dots . Raina kulkee kuten on esitetty kuvion 1 suoritusmuodossa siirtohihaan H_{100} kiinnittyneenä aina ryhmän R_I lopulle, jossa siirtoviiran H_3 sekä siirtoimutelan S_{200} avulla ja sen aikaansaamalla imulla irrotetaan raina W siirtohihnan H_{100} pinnasta ja siirretään se siirtoviiran H_3 mukana toiseen kuivatussynteriryhmään R_{II} , joka voi olla tavanomainen yksiviiravientiryhmä, jonka siirtoimutelan S_1

10 tuntumaan raina ensimmäisenä tuodaan ja siirretään edelleen tavanomaisessa yksiviiraviennin H_1 käsittävässä kuivatussynteriryhmässä R_{II} .

Kuviossa 7B on esitetty muuten kuviota 7A vastaava suoritusmuoto, mutta jossa ei

15 ole erillistä siirtoviiralenkkiä H_3 ja jossa raina poimitaan pelkästään siirtoimutelan S_{300} avulla ensimmäisen ryhmän R_I siirtohihnalta H_{100} toiseen kuivatussynteriryhmään R_{II} .

Kuviossa 8 on esitetty muuten kuviota 1 vastaava suoritusmuoto, mutta jossa

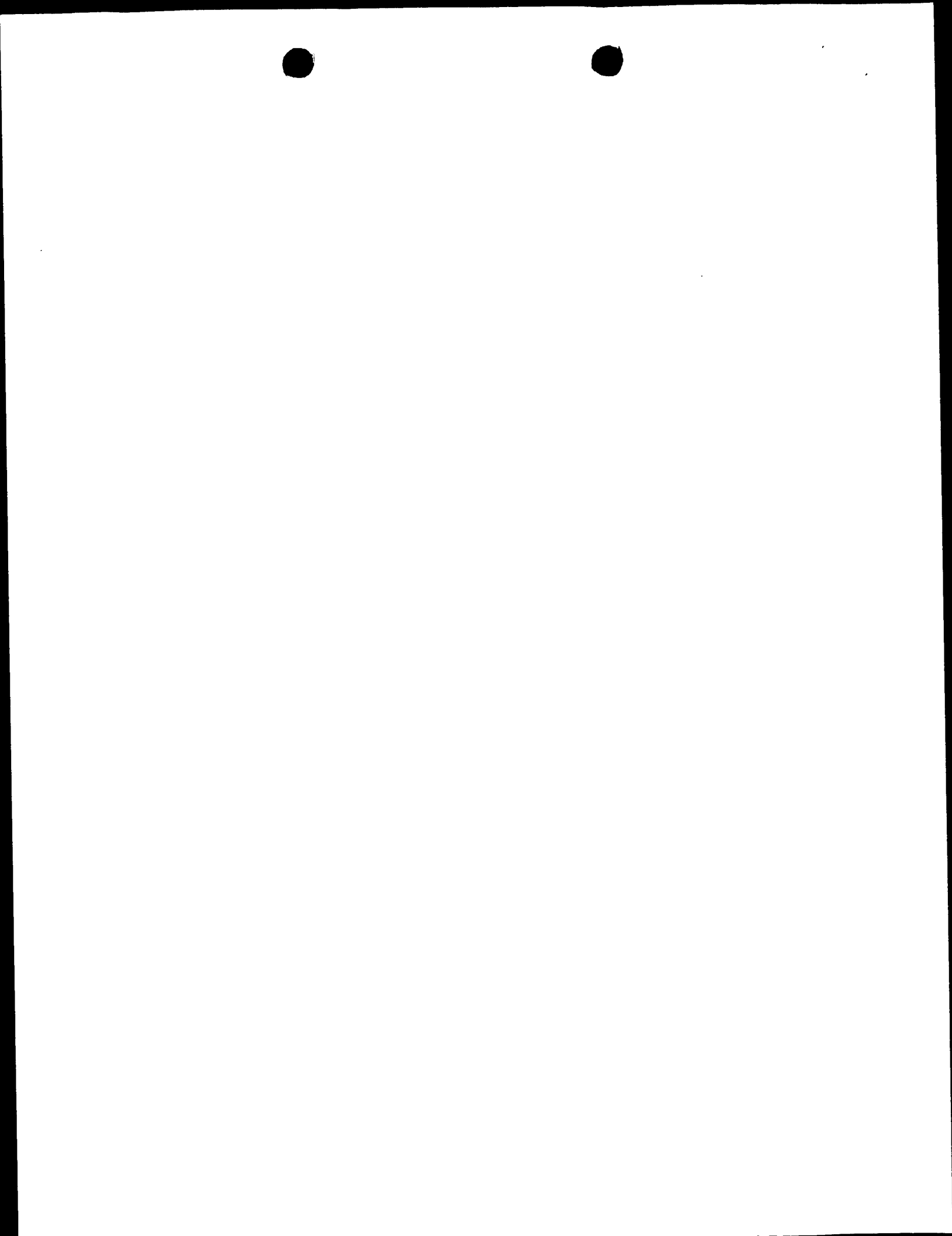
20 suoritusmuodossa toinen kuivatussynteriryhmä R_{II} on tavanomainen kaksiviirakuivatussynteriryhmä. Kuvion 8 kuivatussynteriryhmä poikkeaa lisäksi kuvion 1 suoritusmuodosta siinä, että kääntötelat E_1, E_2 sijaitsevat kuvion 8 suoritusmuodossa alapuolisessa positiossa verrattaessa kuivatussynterisiin K_1, K_2, K_3 . Ryhmän I lopulla raina W poimitaan siirtohihnan H_{100} pinnalta siirtoimutelan D_{10} avulla, joka

25 sijaitsee toisen kuivatussynteriryhmän R_{II} alapuolisen viiralenkin H_{200} sisäpuolella.

Edellä kuvioissa 4 - 8 selostetuissa suoritusmuodoissa on selvää, että kuivatussynterien jälkeisten kääntötelojen E_1 yhteyteen voidaan asettaa lisäksi päällepuhailuslaitteet, kuten on esitetty kuvioissa 3A ja 3B.

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Kuvion 9A mukaisessa ratkaisussa viimeisessä puristinnipissä alahuovan paikalla on siirtohihna H_{100} (TransBelt). Normaalisti rata W otetaan irti siirtohihnalta H_{100} heti



puristimen jälkeen, mutta keksinnön mukaisessa ratkaisussa rata viedään taittotelana tai kuivatussylinterin kautta päällepuhallustelalle. Koska rata on puristamisen jälkeen tiukasti kiinni siirtohihnan pinnassa, ei rataa tarvitse tukea millään tavalla päällepuhalluskuivatuksen aikana. Päällepuhallusyksikön jälkeen rata siirretään ensimmäiselle
5 kuivatussylinterille ja jatketaan kuivatusta normaalisti 1-viiraviennissä.

Siirtohihnan H_{100} taittotela tai kuivatussylinteri $12a_n$ voi olla pinnoitettu, jos teräs, kumi tai suomugrafiittivalurauta aiheuttaa tarttumisongelmia. Toinen mahdollisuus on käyttää sylinterissä niin suurta höyrynpainetta, että radan ja sylinterin väliin muodostuu höyrykalvo, jolloin raina ei tartu kiinni sylinterin pintaan.
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Päällepuhallusyksiköt $11a_1$, $11a_2$ käsittävä tela 100 voi tässä tapauksessa olla sileä tela. Telan päällä rataa kohdistetaan päällepuhallus, jolloin paperin kuiva-aine nousee ennen kuin siirrytään 1-viiravientigeometriaan. Päällepuhallusyksiköiden huuvia on merkitty $130a_1$, $130a_2$. Niiden päällepuhallusväliaineen kuten ilman purkupinta sijaitsee rainan W tuntumassa. Rainan W seuratessa siirtohihnan H_{100} pinnalla telan 100 pinnan myötäisesti.
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Kuviossa 9A on esitetty siirtohihnan H_{100} käyttö puristimen P viimeisen puristimen $10a_1$, $10a_2$ yhteydessä, edullisesti pitkänippipuristimen yhteydessä, joka pitkänippipuristin käsittää pitkänippitelan $10a_1$, jossa on joustava hihnavaippa, joka mukautuu edullisesti sileäpintaisen vastatelan $10a_2$ pinnan muotoon pitkänippitelan käsittäessä sen keskiakseliin liittyvän hihnavaipan sisäpuolisen kuormituskengän, jonka kuormituspinnan muoto vastaa vastatelan pinnan muotoa.
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Keksinnön mukaisesti siirtohihna H_{100} , johon raina kiinnittyy nipissä N_1 , siirretään edelleen päällepuhallusyksikölle $11a_1$ ja $11a_2$, jotka on sovitettu suurihalkaisijaisen telan 100 pinnan tuntumaan. Kuvion 9A suoritusmuodossa on telan 100 halkaisija 3600 mm, jolloin päällepuhallusmatkaa saadaan 7,9 m. Päällepuhalluskokonaisuus kuvion 9A suoritusmuodossa on kaksiosainen käsittäen päällepuhallusyksiköt $11a_1$ ja $11a_2$. Kunkin päällepuhallusyksikön $11a_1$, $11a_2$ kautta puhalletaan lämmönsiirtoväliainetta kuten lämmintä ilmaa tai höyryä rainan W yhteyteen sen kuivattamiseksi.
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Kuviossa esitetysti on siirtohihna H_{100} viety ohjaustelojen $12a_3, 12a_4 \dots$ kautta. Yläpuolinen huopa H_N , on myös viety pitkänippipuristimen puristinnipin N_1 kautta ja ohjattu ohjaustelojen $13a_1, 13a_2 \dots$ avulla. Siirtohihnalta H_{100} raina W siirretään siirtoimutelan 300 kautta kuivatusosaan K ensimmäiseen kuivatusryhmään R_1 , joka

5 käsittää tavanomaisen kuivatusviirajuoksun H_1 .

Kuivatusosa K , sen kuivatussyylinteriryhmä R_1 , käsittää kuivatussyylinterit $K_1, K_2 \dots$ sekä imussyylinterit (VacRoll-tyyppiset) $S_1, S_2 \dots$. Kuivatusosa K on tavanomainen kuivatusosarakenne. Se käsittää edullisesti useita kuivatussyylinteriryhmiä, mutta

10 olennaista koko rakenteessa on se, että siirtohihna H_{100} sijaitsee siten rakenteessa, että sen avulla paperi- tai kartonkiraina W siirretään puristinosalta P kuivatusosalle K .

Mitoitusesimerkki kuvion 1 geometrialle (telan halkaisija 3600 mm):

- 15 — nopeus 2000 m/min
 — haihdutusnopeus $120 \text{ kg}/(\text{m}^2\text{h})$
 — päällepuhallustelan halkaisija 3,6 m (peitto 215 astetta)
 — kuiva-aineen nousu $45 \rightarrow 48,5 \%$.
- 20 3,5 %:n kuiva-aineen nousu merkitsee huomattavaa parannusta rainan lujuusominaisuuksissa ja rainan siirto sylinteriltä eteenpäin tässä kuiva-aineessa on jo huomattavasti varmempaa kuin 45 %:n kuiva-aineessa.

Kuviossa 9B keksinnön mukaisessa geometriassa on myös mahdollista käyttää

25 lisäpäällepuhallusyksikköä 500 ennen taittotelaa $12a_n$, jolloin päällepuhallus tapahtuisi tason päällä. Tällä ratkaisulla olisi se etu, että radan lämpötilaa voidaan nostaa ennen varsinaista päällepuhalluskuivatusta. Riippuen tukemattoman viennin pituudesta voidaan siirtohihnaa H_{100} tukea alapuolelta esimerkiksi riittävällä määrällä tukiteloja $120a_1, 120a_2 \dots$

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Kuviossa 10 on esitetty muuten kuviota 9A vastaava suoritusmuoto, mutta kuvion suoritusmuodossa tela 100 käsittää vielä suuremman halkaisijan 4800 mm kuin on

esitetty kuvion 9A ratkaisussa. Tällöin päällepuhallusmatkaksi saadaan 10 m. Vastaavasti päällepuhalluksen aikaansaama kuiva-aineen nousu on suurempi kuin kuvion 9A mukaisessa ratkaisussa.

- 5 Kuviossa 11 on esitetty keksinnön suoritusmuoto, jossa tela 100 on korvattu pitkänomaisella päällepuhallusyksikön $11a_1$ päällepuhallushuuvalla 110. Siirtohihna-juoksu H_{100} on muuten vastaava kuin kuvion 9 ja 10 suoritusmuodossa. Siirtohihna-juoksu H_{100} käsittää tässä suoritusmuodossa suoran lineaarisen juoksutusosuuden D_1 puristinosan P viimeisen puristimen, edullisesti pitkänippipuristimen ja kuivatusosan
- 10 K ensimmäisen kuivatusryhmän R_1 välillä. Tukitelat $120a_1, 120a_2, 120a_3, 120a_4, 120a_5$ tukevat siirtohihnan H_{100} juoksua ja pitkänomainen päällepuhallusyksikön huuva 110 on kuvion suoritusmuodossa asetettu juoksulle D_1 . Päällepuhallusmatka on noin 10 m. Tällöin saadaan huomattava kuivatusteho. Kuviossa esitetysti imutelan 300 avulla siirretään raina siirtohihnan H_{100} pinnalta kuivatusosan K ensimmäisen kuivatusryh-
- 15 män R_1 kuivatusviiran H_1 pinnalle ja eteenpäin kuivatusosassa K.

- Kuviossa 12 on esitetty muuten kuviota 11 vastaava suoritusmuoto, mutta kuvion suoritusmuodossa on päällepuhallusmatkaa kasvatettu sijoittamalla tukirullat $120a_1, 120a_2 \dots$ pystysuuntaisesti ja sijoittamalla päällepuhallusyksiköt $11a_1$ ja $11a_2$
- 20 tukirullien $120a_1, 120a_2 \dots$ molemmille puolille. Tukirullat $120a_1, 120a_2 \dots$ sijaitsevat akseleiltaan pystytasossa Y_1 ja siirtohihna H_{100} on viety tukirullien $120a_1, 120a_2 \dots$ myötä ensin ylöspäin ja viimeisen pystypinossa olevan tukirullan ympäri ja tämän jälkeen alaspäin vastaavien tukirullien $120a_1, 120a_2 \dots$ kautta. Tukirullien $120a_1, 120a_2 \dots$ kummallakin puolella on siten päällepuhallusyksiköt $11a_1, 11a_2$, joiden
- 25 kautta puhalletaan lämmintä ilmaa, höyryä tai muuta lämmitysväliainetta rainan W yhteyteen sen kuivattamiseksi. Päällepuhallusyksiköiden $11a_1, 11a_2 \dots$ huuvat $110a_1, 110a_2 \dots$ ovat pitkänomaisia rakenteita.

- Kuviossa 12 on vielä esitetty ratkaisu, joissa radan vienti tapahtuu suoraviivaisesti
- 30 beltillä ylöspäin (voi olla myös alaspäin). Kuvion 12 ratkaisun etuna on kuivatusosan huomattava lyheneminen pituussuunnassa. Korkeussuunnassa sen sijaan tarvittava tila on suurempi.

Kuviossa 13 on esitetty kuviota 11 vastaava rakenne. Kuvio suoritusmuodoltaan poikkeaa kuvion 1 suoritusmuodosta kuivatusosan K kuivatusryhmän R_I tulopuolen rakenteen osalta. Kuivatusosan K alku käsittää imulaatikot J_1, J_2 imusylinterin M jälkeen.

5

Vaikka kuvioissa 11, 12 ja 13 on esitetty lineaariset pitkät siirtohihnaviennit, ei keksintö rajoitu pelkästään tällaisiin vienteihin, vaan siirtohihnavienti voi olla myös kaareva, milloin se konegeometrian, ylläpidettävän hihnan kireyden tai ajettavuuden, tms. tekijän kannalta on edullista.

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Patenttivaatimukset

1. Laitteisto paperi-/kartonkirainan (W) siirrossa paperi- tai kartonkikoneessa, **tunnettu** siitä, että rainan (W) siirrossa käytetään siirtohihnaa (H_{100}), johon raina
5 (W) kiinnittyy adheesion vaikutuksesta ja joka siirtohihna on johdettu siten paperiko-
neen/kartonkikoneen yhteydessä, että se on kosketuksessa puristinosan (P) viimeisen
puristimen puristinnipin muodostamaan telaan ($10a_1$ tai $10a_2$ tai S_{100}) ja että raina
(W) johdetaan puristimelta siirtohihnaan (H_{100}) kiinnittyneenä eteenpäin ja että
rainaan tuodaan lämpöenergiaa sen ollessa siirtohihnaan (H_{100}) kiinnittyneenä.
- 10
2. Patenttivaatimuksen 1 mukainen laitteisto rainan (W) siirrossa paperi- tai kartonki-
koneessa, **tunnettu** siitä, että kuivatusosa käsittää ainakin yhden kuivatussylin-
teriryhmän, jossa tavanomaisen viiraviennin sijasta käytetään siirtohihnaa (H_{100}),
johon raina (W) kiinnittyy adheesion vaikutuksesta ja joka siirtohihna on johdettu
15 kuivatussylinterien (K_1, K_2, \dots) ja kääntötelojen (E_1, E_2, \dots) kautta ja eteenpäin maini-
tussa kuivatusosan kuivatussynteriryhmässä (R_f).
3. Patenttivaatimuksen 1 mukainen laitteisto rainan (W) siirrossa paperi- tai kartonki-
koneessa, **tunnettu** kuivatusosan ainakin ensimmäisessä kuivatussynteriryhmässä
20 (R_f) on siirtohihna (H_{100}).
4. Jonkin edellä olevan patenttivaatimuksen mukainen laitteisto rainan (W) siirrossa
paperi- tai kartonkikoneessa, **tunnettu** siitä, että siirtohihna (H_{100}) on ilmaa ja vettä
läpäisemätön.
- 25
5. Jonkin edellä olevan patenttivaatimuksen mukainen laitteisto rainan (W) siirrossa
paperi- tai kartonkikoneessa, **tunnettu** siitä, että kääntötelat (E_1, E_2, \dots) ovat sileäpin-
taisia teloja ja että raina (W) kulkee telojen (E_1, E_2, \dots) kohdalla siirtohihnan (H_{100})
siirtämänä ja pysyy siirtohihnan (H_{100}) pinnalla siirtohihnan (H_{100}) rainan kohdist-
30 man adheesiovoiman vaikutuksesta.

6. Jonkin edellä olevan patenttivaatimuksen mukainen laitteisto rainan (W) siirrossa paperi- tai kartonkikoneessa, **tunnettu** siitä, että kuivatusosan ensimmäisessä kuivatussyylinteriryhmässä (R_I) suljettuna lenkkinä viety siirtohihnajuoksu on viety lisäksi ainakin puristinosan (P) viimeisen puristimen (P_N) puristintelojen ($10a_1, 10a_2$) puristinnipin (N_I) kautta, jolloin raina (W) kiinnittyy siirtohihnaan (H_{100}) puristinnipissä (N_I) ja rainan vienti puristimelta kuivatusosalle sen ensimmäiseen kuivatussyylinteriryhmään (R_I) on siirtohihnan (H_{100}) tukema ns. suljettu rainavienti.

7. Jonkin edellä olevan patenttivaatimuksen mukainen laitteisto rainan (W) siirrossa paperi- tai kartonkikoneessa, **tunnettu** siitä, että kuivatusosa (K) käsittää siirtohihnalla (H_{100}) varustetun kuivatussyylinteriryhmän (R_I) jälkeen toisen kuivatussyylinteriryhmän (R_{II}), johon raina (W) siirretään suljettuna vientinä ja joka toinen kuivatussyylinteriryhmä (R_{II}) käsittää tavanomaisen viiraviennin (H_2), jolloin raina (W) siirretään kuivatussyylinterien ja imutelojen ($K_1, S_1, K_2, S_2, \dots$) kautta silmukkamaisesti polveillen ja pidetään imutelojen (S_1, S_2, \dots) yhteydessä imutelojen sisäpuolelle aikaansaadun paineen avulla.

8. Jonkin edellä olevan patenttivaatimuksen mukainen laitteisto rainan (W) siirrossa paperi- tai kartonkikoneessa, **tunnettu** siitä, että kuivatussyylinteriryhmä (R_I), joka käsittää siirtohihnajuoksun (H_{100}) on varustettu päällepuhallusyksiköillä ($11a_1, 11a_2, \dots$), joiden kautta tuodaan kuivatusväliaine, edullisesti höyry, kuumennettu ilma tai kuumennettu kaasu rainan (W) yhteyteen kuivatustehon parantamiseksi.

9. Jonkin edellä olevan patenttivaatimuksen mukainen laitteisto rainan (W) siirrossa paperi- tai kartonkikoneessa, **tunnettu** siitä, että siirtohihnan (H_{100}) on johdettu viimeisen puristinosan (P) puristinnipin (N_I) kautta ja siten, että siirtohihna on johdettu ohjaustelojen ($12a_1, 12a_2$) kautta ja että nipin (N_I) kautta on viety lisäksi puristintuopa (H_n), jolloin nipiltä (N_I) raina (W) siirretään siirtohihnan pintaan kiinnittyneenä eteenpäin ja edelleen telalle (100), jonka yhteyteen on asetettu ainakin yksi, edullisesti kaksi, päällepuhallusyksikköä ($11a_1, 11a_2$), joilta johdetun kuuminusväliaineen avulla kuivataan paperi-/kartonkirainaa (W) ja jolta päällepuhallusyksiköt ($11a_1, 11a_2$) käsittävältä telalta (100) raina (W) johdetaan siirtohihnan (H_{100})

pintaan kiinnittyneenä edelleen kuivatusosan (K) ensimmäisen kuivatusryhmän (R_I) yhteyteen.

10. Patenttivaatimuksen 1 mukainen laitteisto, **tunnettu** siitä, että raina (W) johdetaan puristimen (P) viimeisen puristinnipin (N_1) kautta, jonka nipin kautta on johdettu lisäksi siirtohihna (H_{100}), jonka pintaan kiinnittyneenä raina (W) johdetaan edelleen lineaarista juoksua (D_1) pitkin, jonka yhteydessä sijaitsevat tukirullat ($120a_1, 120a_2 \dots$) ja jonka juoksun (D_1) toisella puolella sijaitsee päällepuhallusyksikkö ($11a_1$), joka käsittää pitkänomaisen huuван (110) ja että päällepuhallusyksikön ($11a_1$) jälkeen raina (W) siirretään siirtohihnan (H_{100}) pinnasta kuivatusosan (K) yhteyteen.

11. Patenttivaatimuksen 1 mukainen laitteisto, **tunnettu** siitä, että siirtohihna (H_{100}) on johdettu puristimen (P) viimeisen puristimen ($10a_1, 10a_2$) puristinnipin (N_1) kautta ja että siirtohihnan (H_{100}) pinnalla siihen kiinnittyneenä johdetaan raina (W) pystysuuntaisesti tukitelojen ($120a_1, 120a_2 \dots$) myötäisesti johdetun siirtohihnajuoksun (H_{100}) mukana ylöspäin, jonka juoksun yhteydessä sijaitsee päällepuhallusyksikkö ($11a_1$) ja että viimeiseltä tukitelalta raina (W) johdetaan siirtohihnan (H_{100}) pinnalla alaspäin toisen päällepuhallusyksikön ($11a_1$) yhteyteen ja edelleen toiselta päällepuhallusyksikön ($11a_2$) jälkeen kuivatusosan (K) ensimmäiseen kuivatussynteriryhmään (R_I).

12. Jonkin edellä olevan patenttivaatimuksen mukainen laitteisto, **tunnettu** siitä, että viimeinen puristinnippi (V) on huovaton ns. tasaapuristin.

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13. Menetelmä rainan (W) siirrossa paperikoneen tai kartonkikoneen yhteydessä, **tunnettu** siitä, että raina (W) siirretään siirtohihnan (H_{100}) pinnalla, että raina (W) johdetaan siirtohihnan (H_{100}) pinnalla siihen adheesion avulla kiinnittyneenä puristinosan (P) viimeiseltä puristimelta ($10a_1, 10a_2$ tai $10a_1, S_{100}$) siten, että siirtohihna (H_{100}) on kosketuksessa viimeisen puristimen puristintelaan ($10a_1$ tai S_{100}).

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14. Patenttivaatimuksen 13 mukainen menetelmä rainan siirrossa paperikoneen tai kartonkikoneen yhteydessä, **tunnettu** siitä, että raina (W) johdetaan silmukkamaisesti polveillen siirtohihnan (H_{100}) pintaan kiinnittyneenä kuivatusosan (K) kuivatussylinderiryhmän (R_I) kuivatussylinderiltä (K_I) kääntötölle (E_I) ja edelleen kääntötölta seuraavalle kuivatussylinderille (K_2) ja eteenpäin kuivatussylinderiryhmässä (R_I).

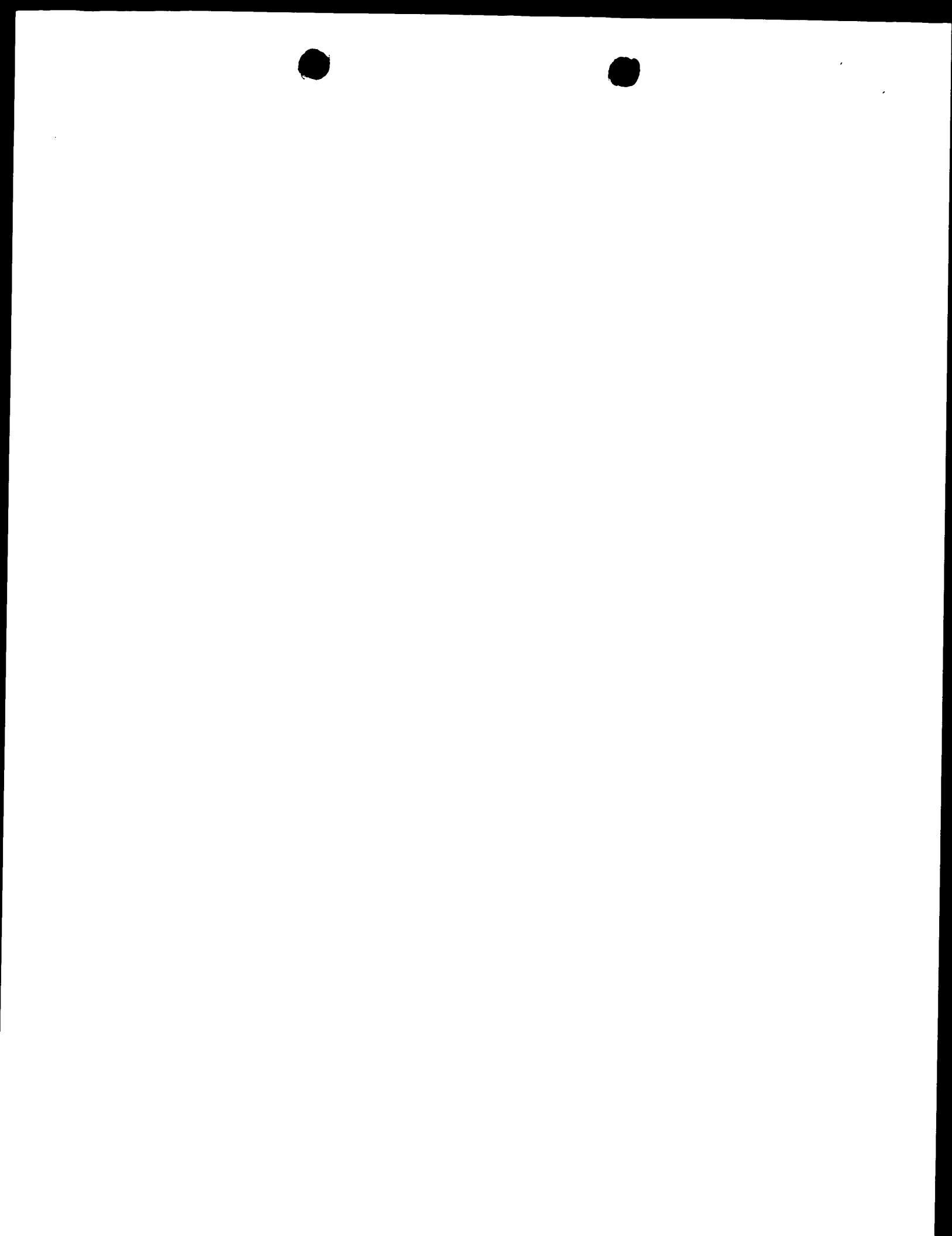
15. Edellä olevan patenttivaatimuksen mukainen menetelmä rainan siirrossa paperikoneen/kartonkikoneen yhteydessä, **tunnettu** siitä, että siirtohihna (H_{100}) on johdettu suljettuna lenkkinä paitsi kuivatusosan (K) kuivatussylinderiryhmän (R_I) kuivatussylinderien (K_1, K_2, \dots) ja kääntötelojen (E_1, E_2, \dots) kautta niin myös puristinosan (P) viimeisen puristimen (P_N) puristinnipin (N_1) kautta.

16. Jonkin edellä olevan patenttivaatimuksen mukainen menetelmä rainan siirrossa paperikoneen/kartonkikoneen yhteydessä, **tunnettu** siitä, että keksinnössä lisätään kuivatustehoa tuomalla lämmönsiirtoväliainetta kuten höyryä, lämmintä ilmaa tai kaasua rainan (W) yhteyteen päällepuhallusyksikön ($11a_1, 11a_2, \dots$) kautta, joka päällepuhallusyksikkö on sovitettu kääntötelan/kääntötelojen (E_1, E_2, \dots) yhteyteen.

17. Jonkin edellä olevan patenttivaatimuksen mukainen menetelmä rainan siirrossa paperikoneen/kartonkikoneen yhteydessä, **tunnettu** siitä, että menetelmässä rainaa (W) siirretään sellaisessa kuivatusosan (K) kuivatusryhmässä (R_I), joka käsittää siirtohihnan (H_{100}) ja jossa kuivatussylinderiryhmässä (R_I) on imutelat korvattu tavanomaisilla kääntöteloilla (E_1, E_2, \dots), jotka käsittävät sileän rei'ittämättömän pinnan (e) ja että tämän jälkeen raina siirretään tavanomaiseen yksivieraviennillä varustettuun kuivatusosan (K) kuivatussylinderiryhmään (R_{II}), jossa se kuljetetaan silmukkamaisesti polveillen kuivatussylinderiltä (K_I) imutelalle (S_I) ja imutelalta (S_I) toiselle kuivatussylinderille (K_2) ja eteenpäin kyseisessä toisessa kuivatussylinderiryhmässä (R_{II}), jossa toisessa kuivatussylinderiryhmässä (R_{II}) käytetään kääntösylintereinä imuteloja.

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18. Jonkin edellä olevan patenttivaatimuksen mukainen menetelmä rainan siirrossa paperikoneen/kartonkikoneen yhteydessä, **tunnettu** siitä, että ensimmäisessä



kuivatussyylinteriryhmässä (R_1) raina (W) siirretään suljettuna lenkkinä kuivatussyylinterien ($K_1, K_2 \dots$), jotka edullisesti ovat höyryllä kuumennettuja kuivatussyylinterejä ja kääntötelojen ($E_1, E_2 \dots$) kautta sekä lisäksi puristimen (P_N) puristinnipin (N_1) kautta, joka puristin (P_N) on edullisesti pitkänippipuristin.

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19. Patenttivaatimuksen 13 mukainen menetelmä rainan siirrossa paperikoneen/kartonkikoneen yhteydessä, **tunnettu** siitä, että raina johdetaan puristinosan (P) viimeiseltä puristimelta siirtohihnan (H_{100}) pintaan kiinnittyneenä, joka siirtohihna (H_{100}) on viety suljettuna lenkkinä puristinnipin (N_1) kautta ja että raina johdetaan siirtohihnan (H_{100}) mukana suuren halkaisijan omaavan telan (100) kautta, joka käsittää yhteydessään ainakin yhden päällepuhallusyksikön ($11a_1, 11a_2 \dots$), jonka kautta johdetaan kuivatusväliainetta kuten lämmintä ilmaa tai höyryä kuivatettavan rainan (W) yhteyteen ja että päällepuhallusyksikön/-yksiköt yhteydessään käsittävältä telalta (100) raina johdetaan edelleen kuivatusosan (K) ensimmäiseen kuivatusryhmään (R_1).

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20. Patenttivaatimuksen 13 mukainen menetelmä rainan siirrossa paperikoneen/kartonkikoneen yhteydessä, **tunnettu** siitä, että menetelmässä raina johdetaan puristinosan viimeiseltä puristimelta ($10a_1, 10a_2$) siirtohihnan (H_{100}) mukana lineaarista siirtohihnajuoksua (D_1) myöten, jonka lineaarisen juoksun (D_1) yhteydessä sijaitsevat tukirullat ($120a_1, 120a_2 \dots$) ja vastakkaisilla puolilla juoksua (D_1) päällepuhallusyksikkö ($11a_1$), joka on pitkänomaisen huuven (110) käsittävä rakenne, jonka kautta johdetaan lämmitysväliainetta kuten lämmintä ilmaa tai höyryä rainan (W) yhteyteen sen kuivattamiseksi ja että päällepuhallusyksikön jälkeen raina (W) johdetaan siirtohihnalta kuivatusosan (K) ensimmäiseen kuivatussyylinteriryhmään (R_1).

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21. Patenttivaatimuksen 13 mukainen menetelmä rainan siirrossa paperikoneen tai kartonkikoneen yhteydessä, **tunnettu** siitä, että menetelmässä raina johdetaan siirtohihnan (H_{100}) pintaan kiinnittyneenä puristinosan (P) viimeiseltä puristimelta ($10a_1, 10a_2$) niin, että raina (W) saatetaan kulkemaan ensin pystysuuntaisesti tukitelojen ($120a_1, 120a_2 \dots$) tukeman siirtohihnan (H_{100}) mukana ylöspäin, jolloin mainitun

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pystysuuntaisen juoksun yhteydessä sijaitsee ensimmäinen päällepuhallusyksikkö ($11a_1$) ja että raina saatetaan viimeiseltä tukitelalta kulkemaan tukitelojen (120_n , $120a_{n-1} \dots$) pinnan myötäisesti alaspäin johdetun siirtohihnan (H_{100}) mukana, jonka alaspäin olevan juoksun yhteydessä on toinen päällepuhallusyksikkö ($11a_2$) ja että

5 raina (W) johdetaan toisen päällepuhallusyksikön ($11a_2$) jälkeen siirtohihnalta (H_{100}) kuivatusosan (K) ensimmäiseen kuivatussynteriryhmään (R_1).

Tiivistelmä

Keksinnön kohteena on laitteisto ja menetelmä paperi-/kartonkirainan siirrossa paperi- tai kartonkikoneessa. Keksinnön eräässä suoritusmuodossa kuivatusosa käsittää ainakin yhden kuivatussynteriryhmän, jossa tavanomaisen viiraviennin sijasta käytetään siirtohihnaa (H_{100}), johon raina (W) kiinnittyy adheesion vaikutuksesta ja joka siirtohihna on johdettu kuivatussynterien ($K_1, K_2 \dots$) ja kääntötelojen ($E_1, E_2 \dots$) kautta ja eteenpäin mainitussa kuivatusosan kuivatussynteriryhmässä (R_1). Keksinnön kohteena on myös menetelmä rainan (W) siirrossa paperikoneen/kartonkikoneen kuivatusosalla (K). Keksinnön eräässä suoritusmuodossa raina (W) johdetaan silmukkamaisesti polveillen siirtohihnan (H_{100}) pintaan kiinnittyneenä kuivatusosan (K) kuivatussynteriryhmän (R_1) kuivatussynteriltä (K_1) kääntötelalle (E_1) ja edelleen kääntötelalta seuraavalle kuivatussynterille (K_2) ja eteenpäin kuivatussynteriryhmässä (R_1).

(FIG. 1)

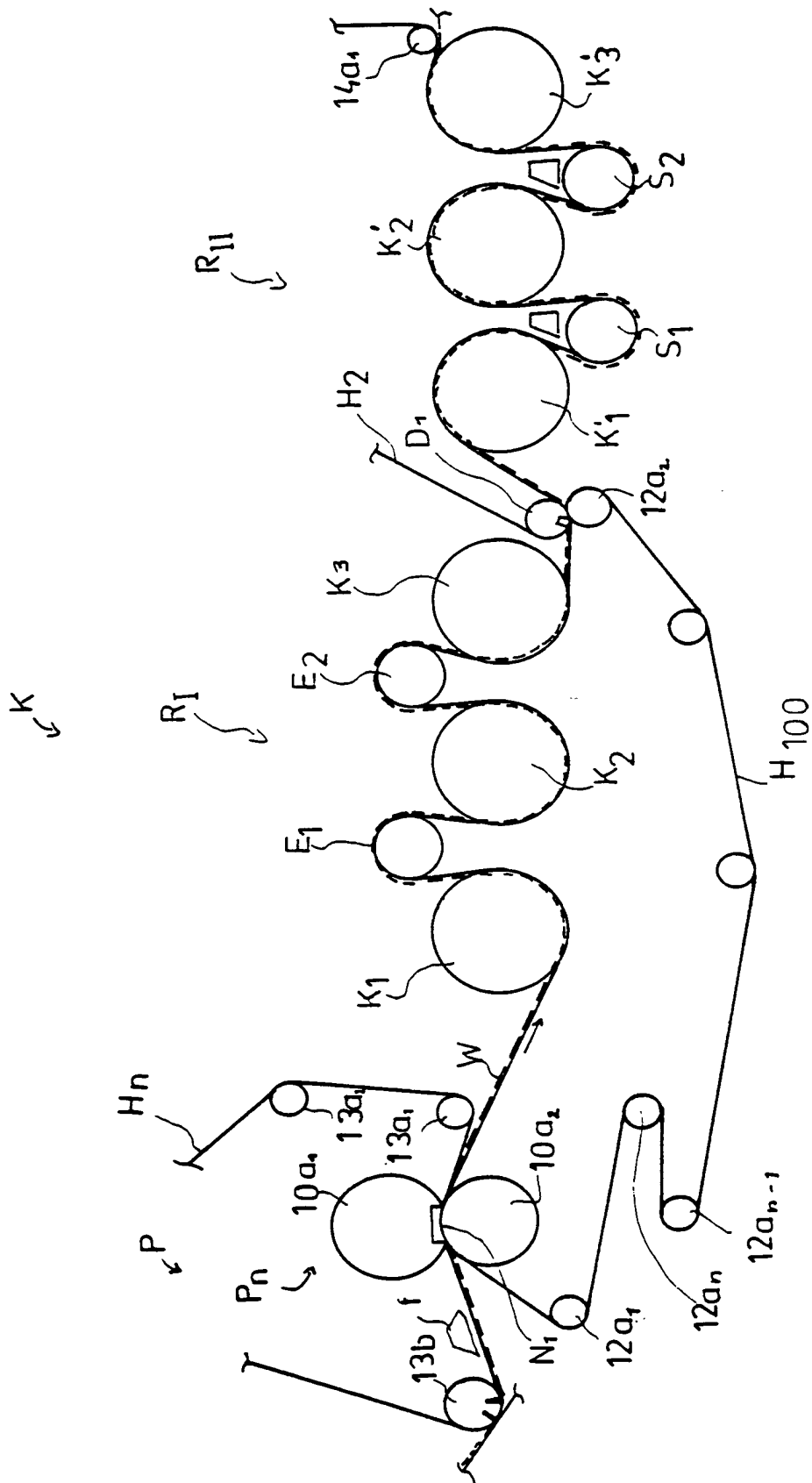


FIG. 1



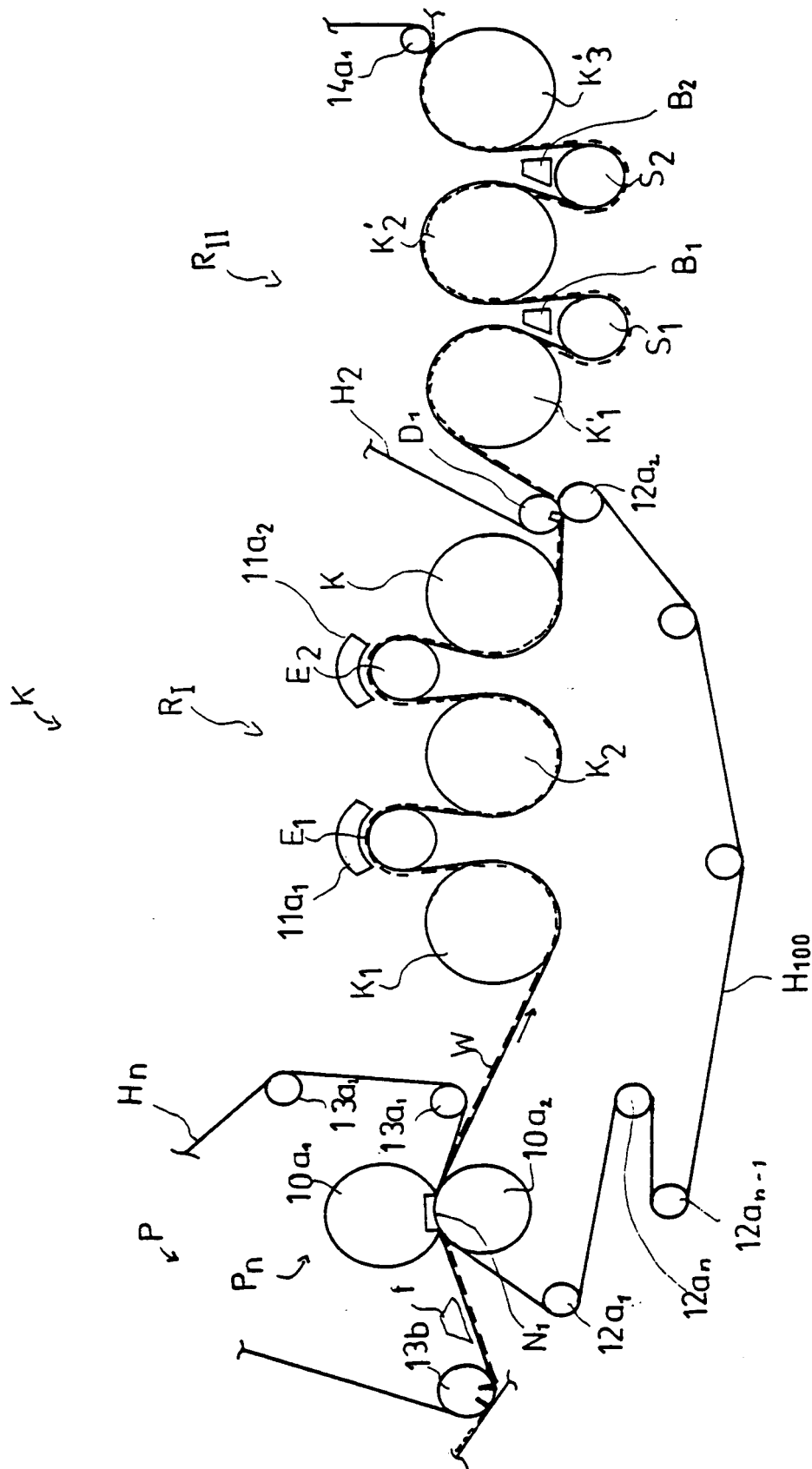


FIG. 2

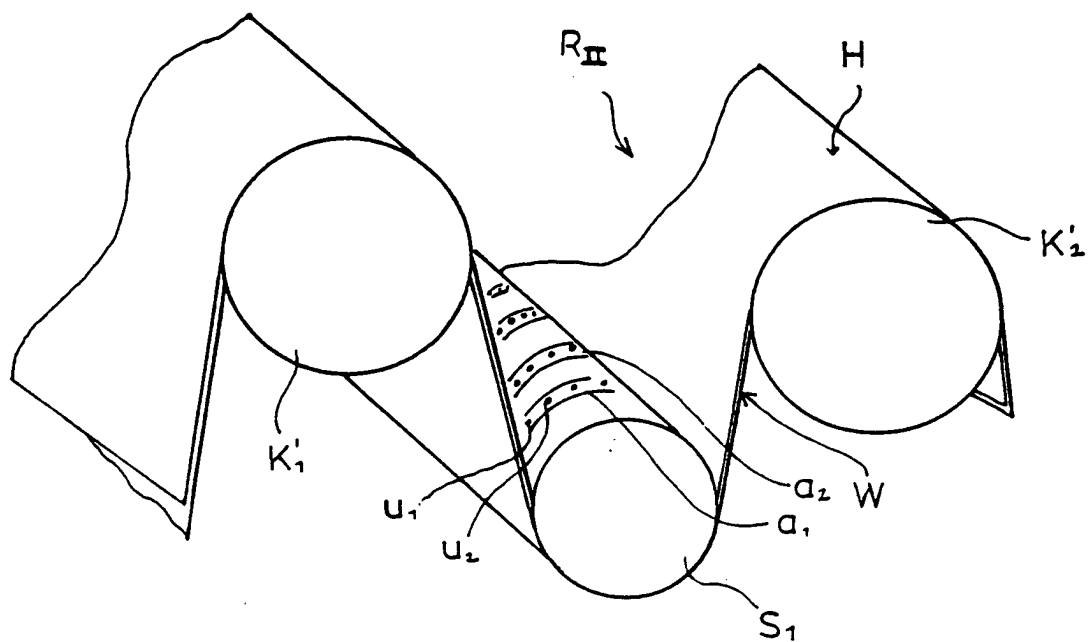


FIG. 3A

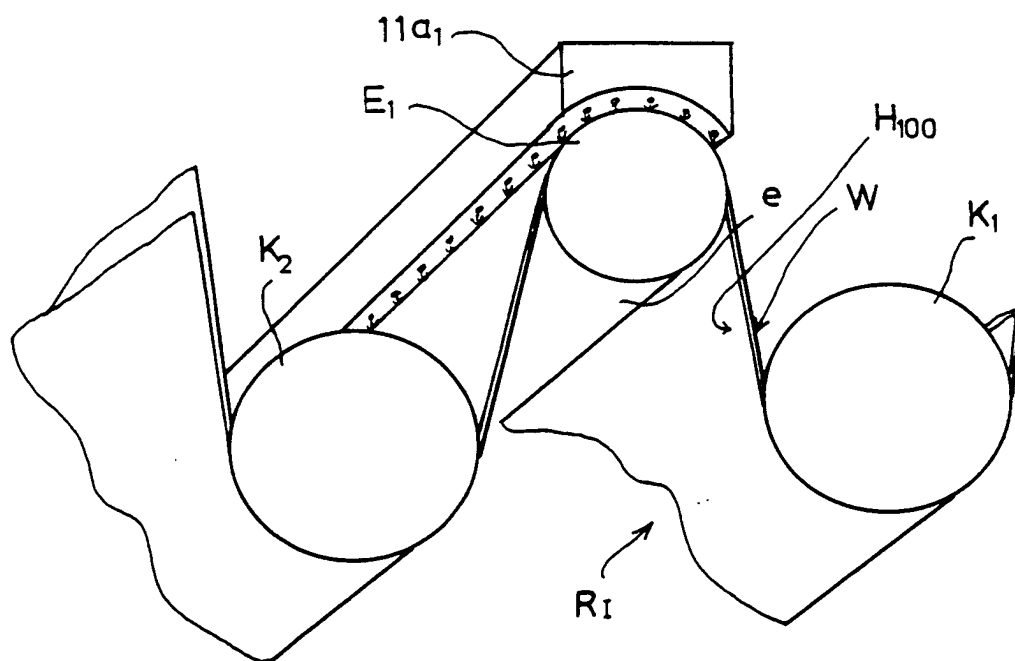


FIG. 3B

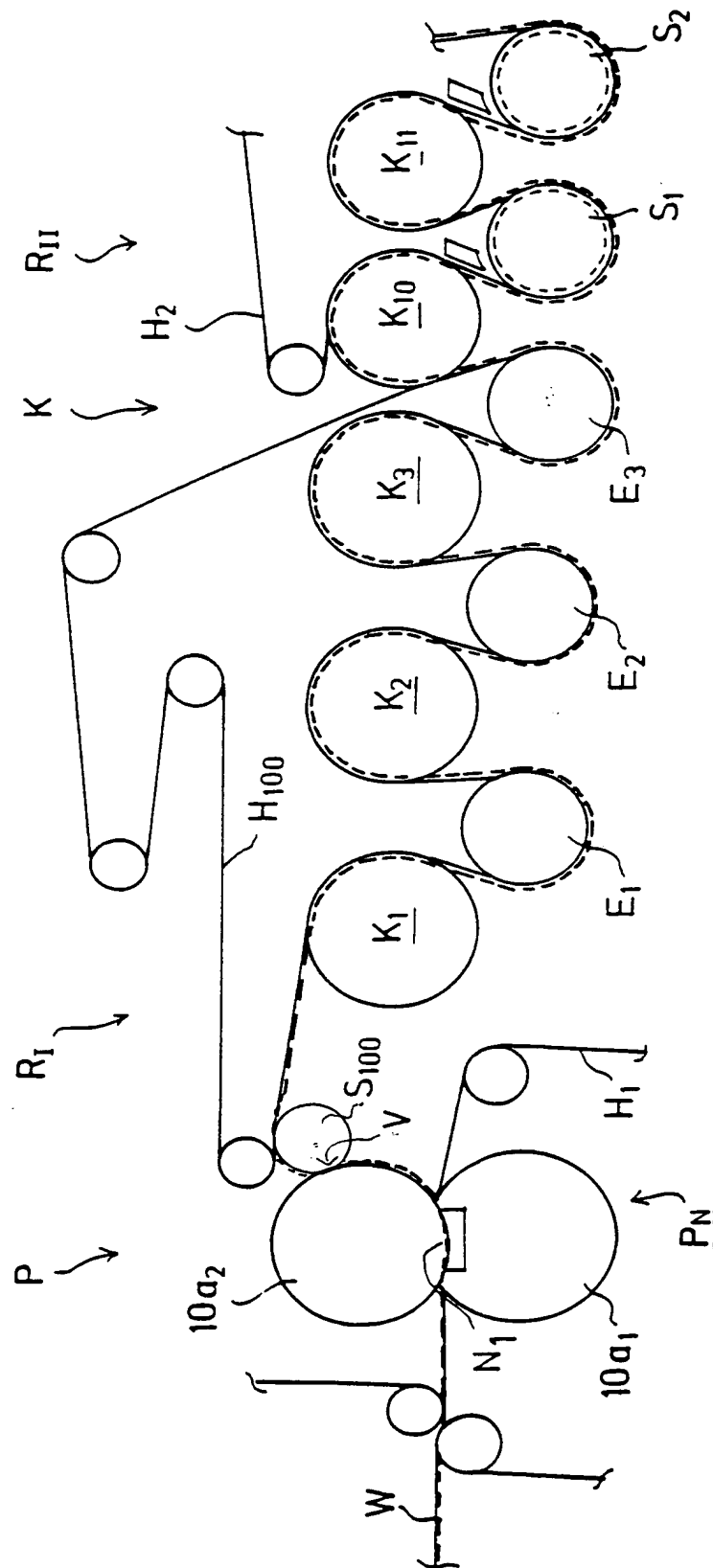


FIG. 4

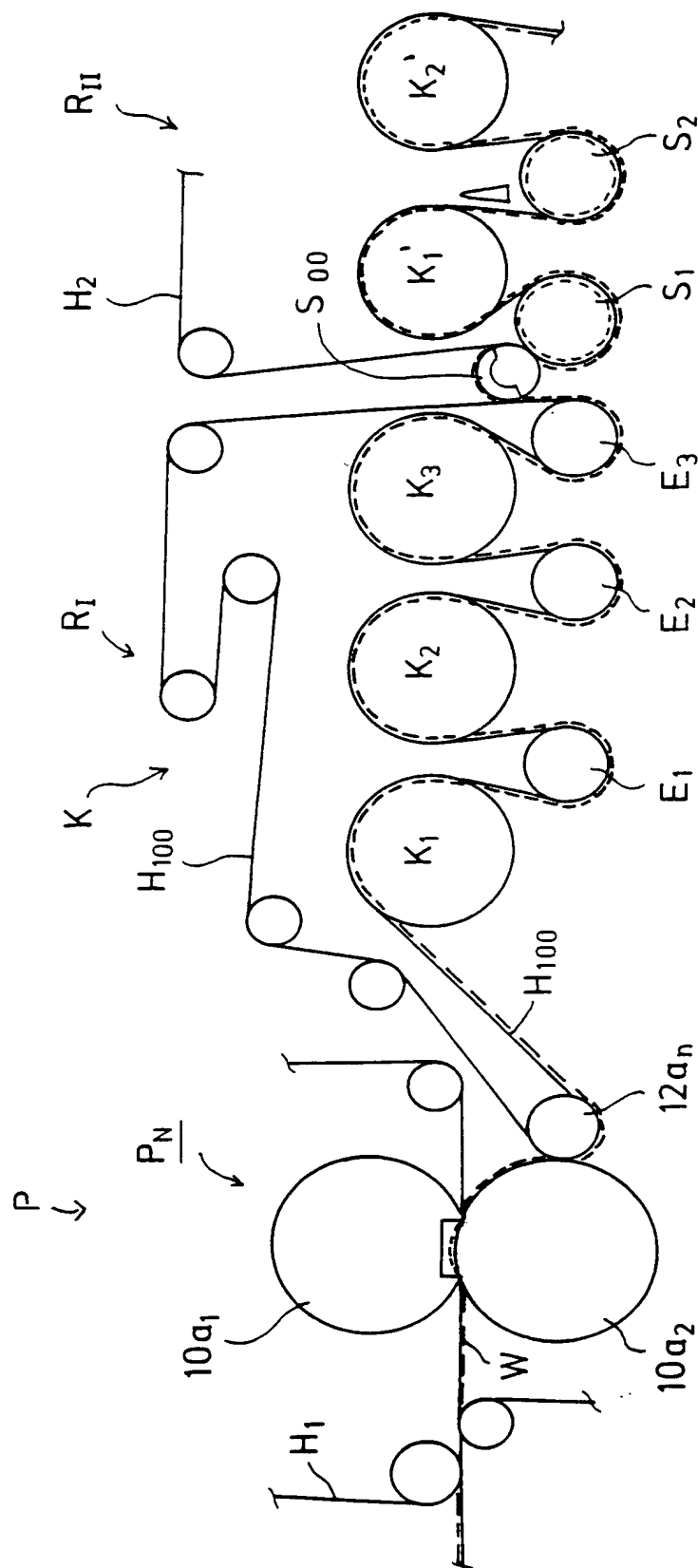


FIG. 5

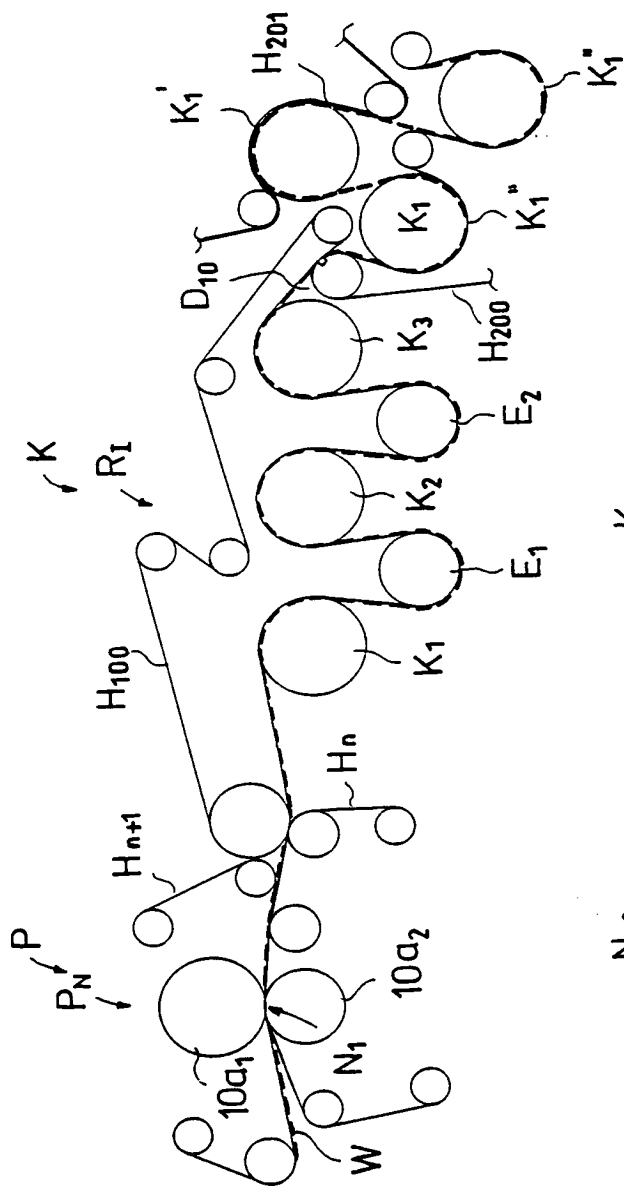


FIG. 6A

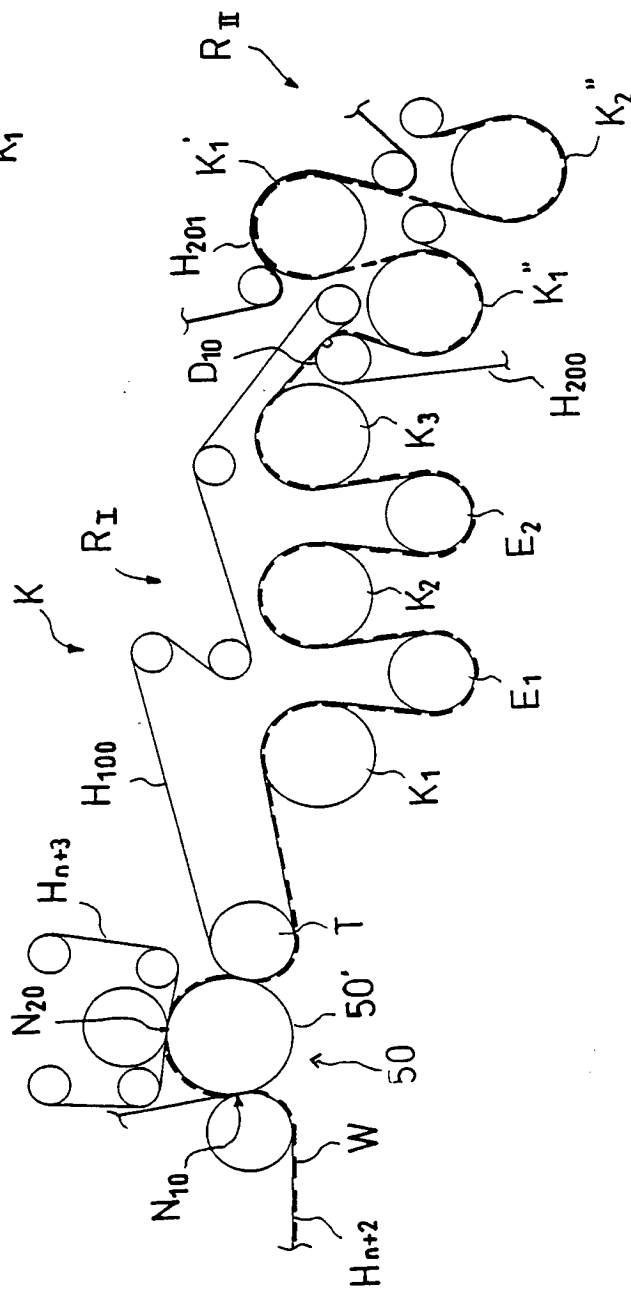


FIG. 6B

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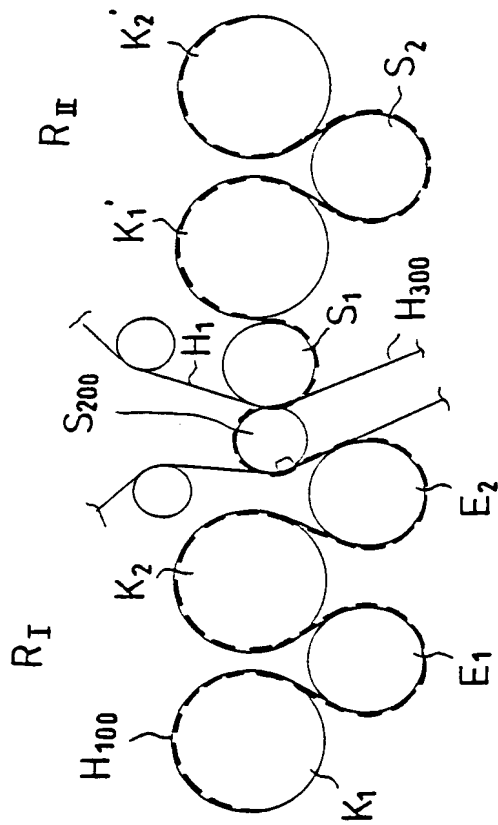


FIG. 7A

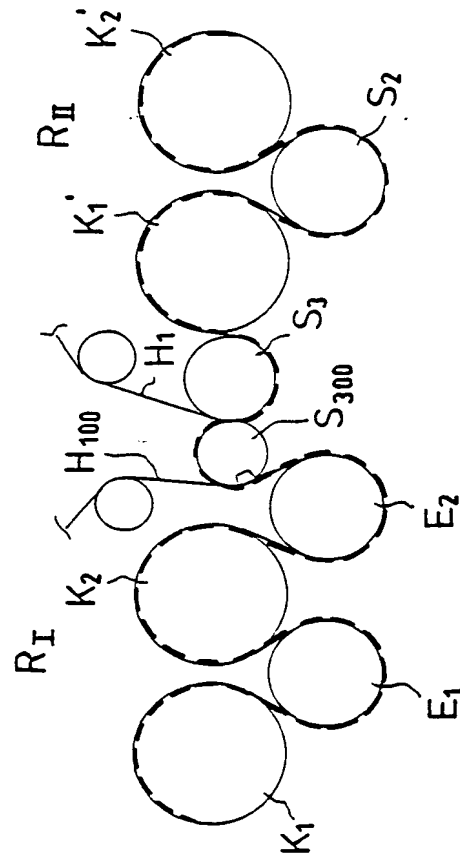


FIG. 7B

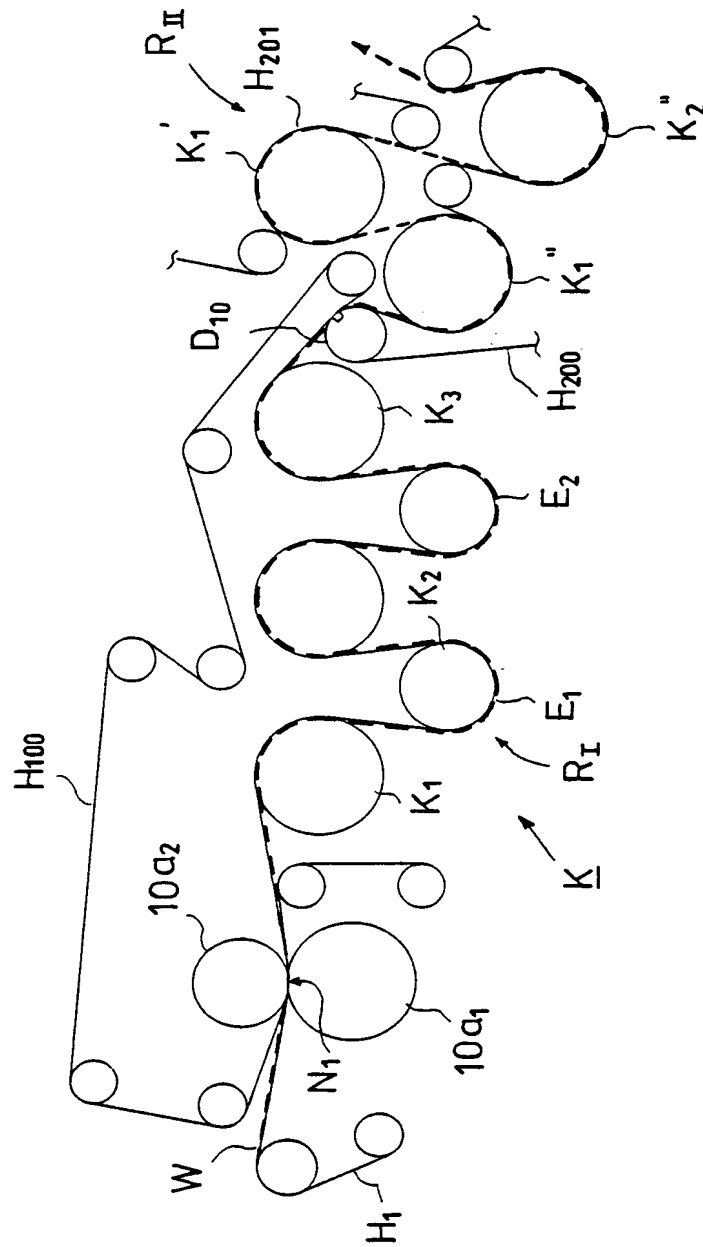
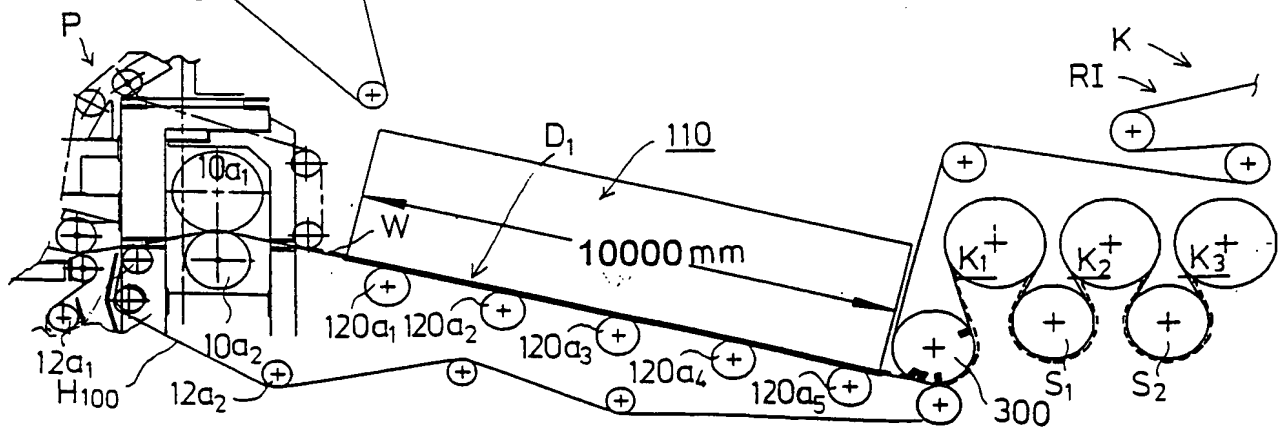
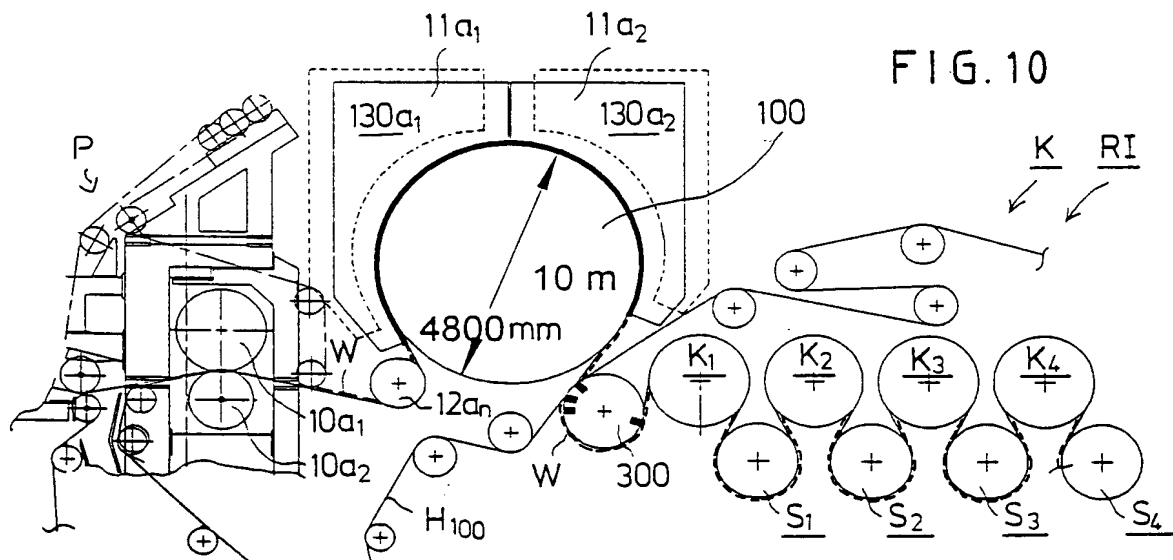
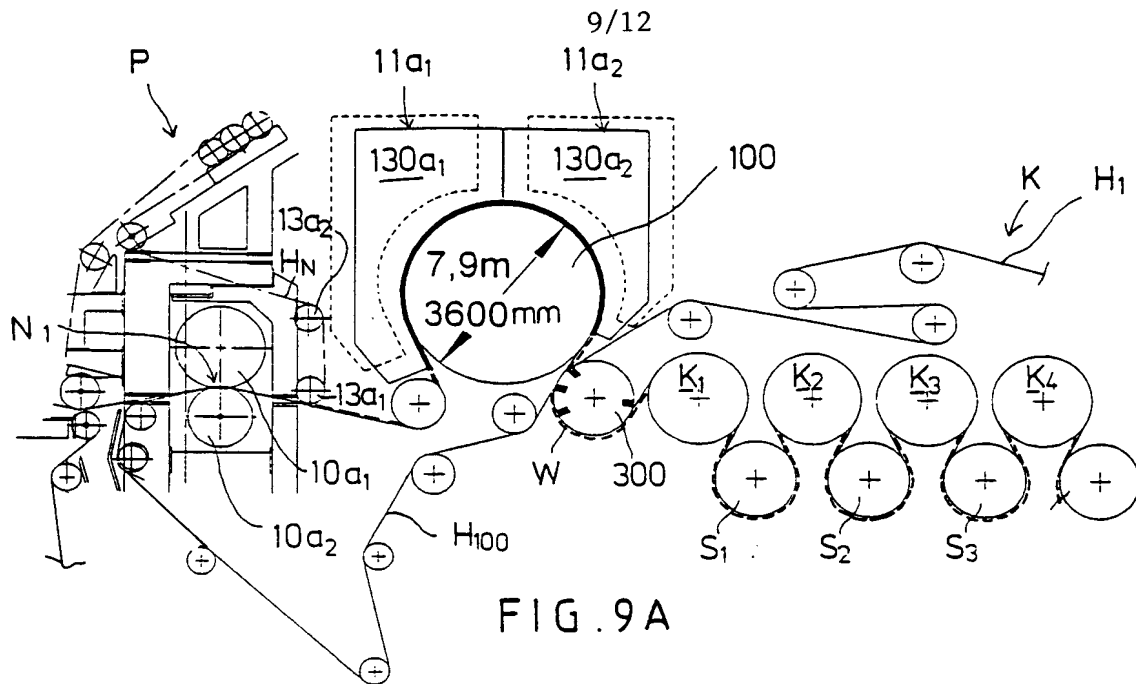
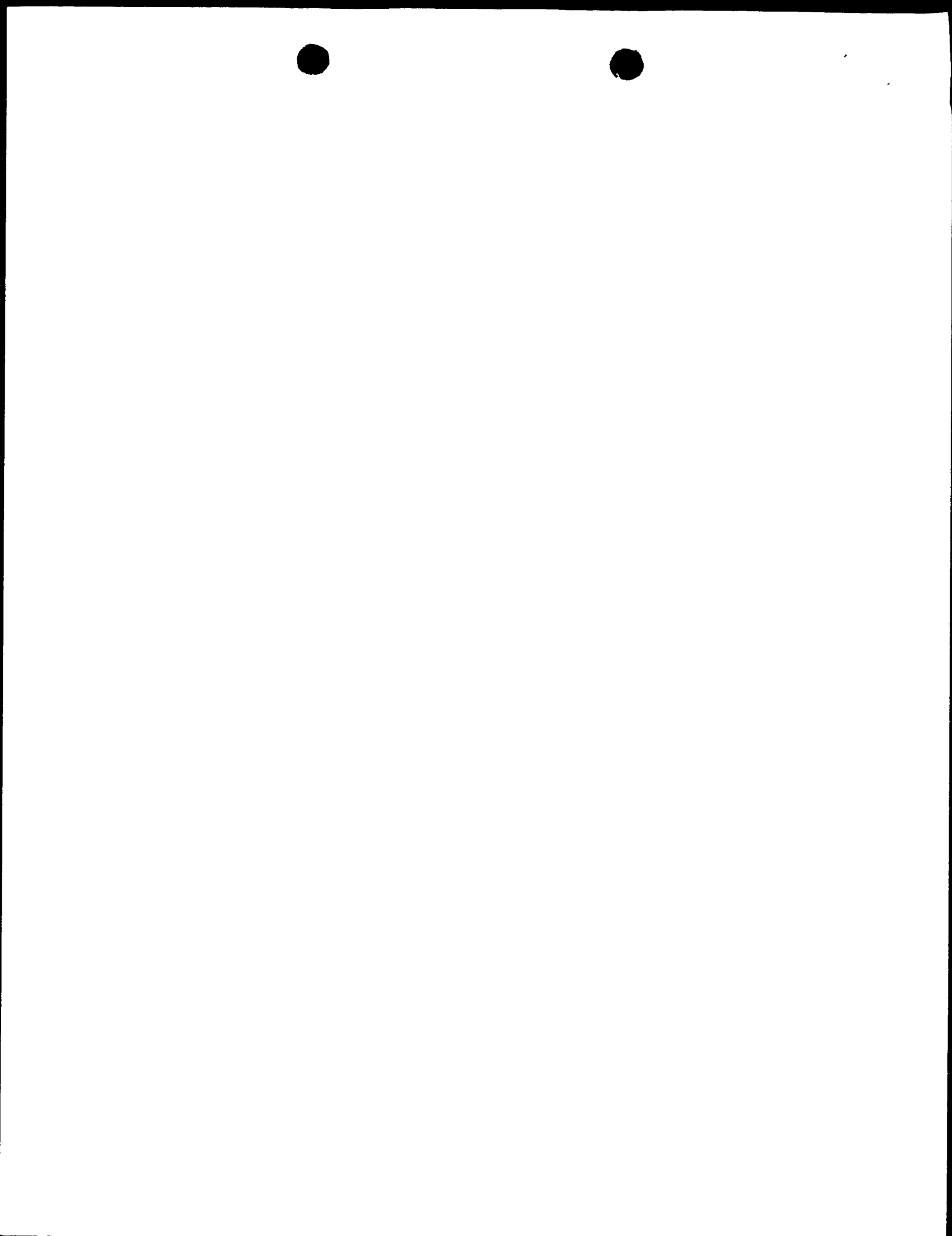


FIG. 8





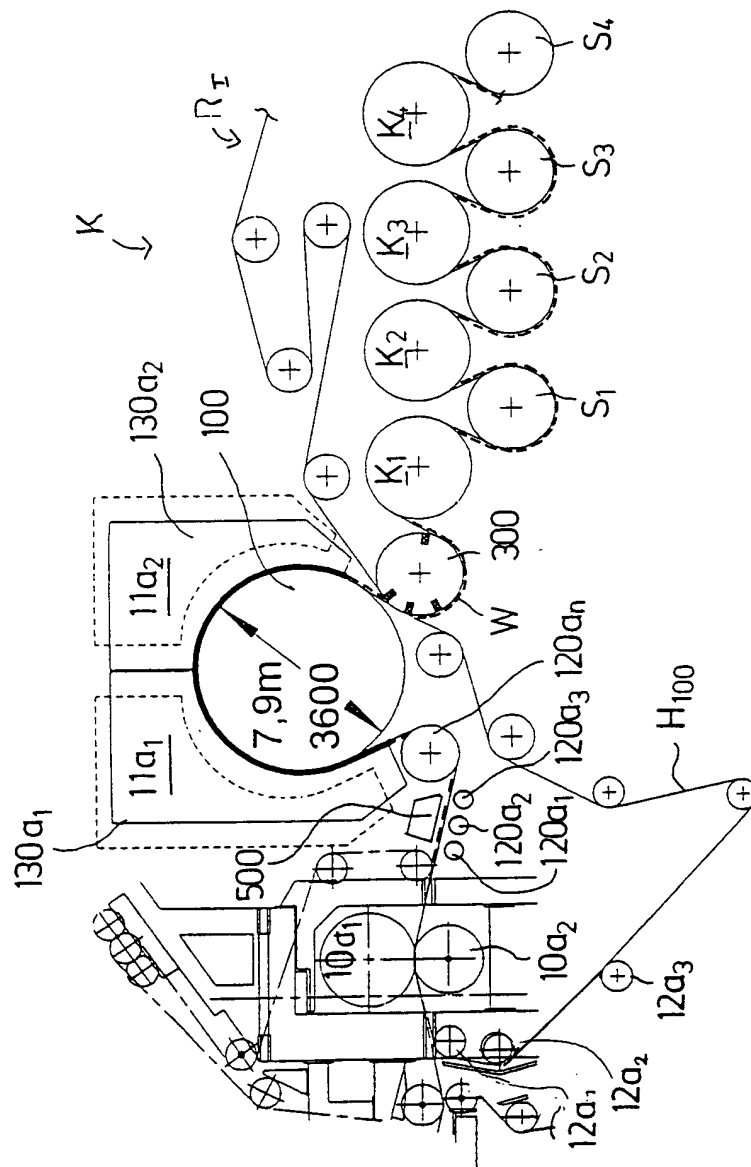
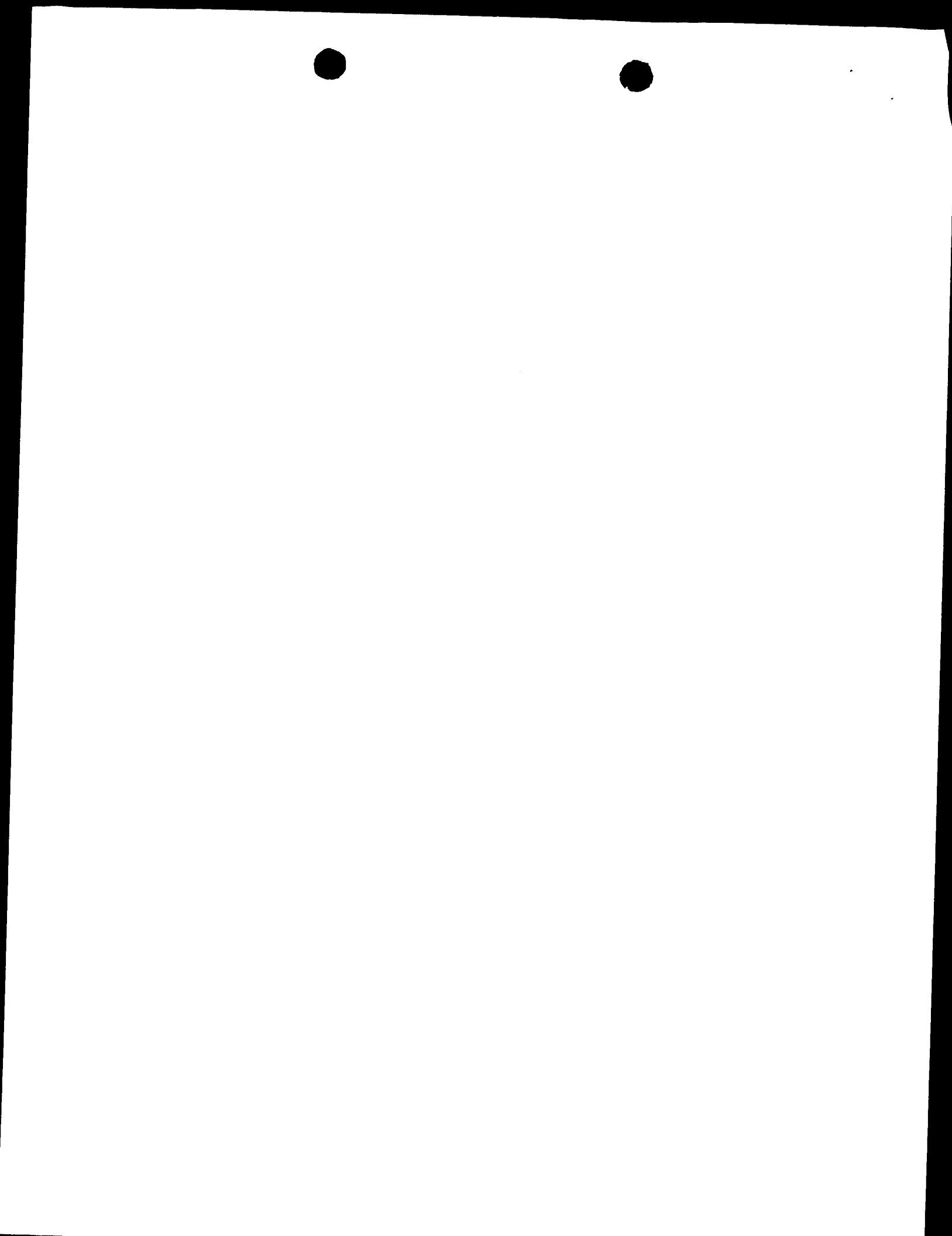


FIG. 9B



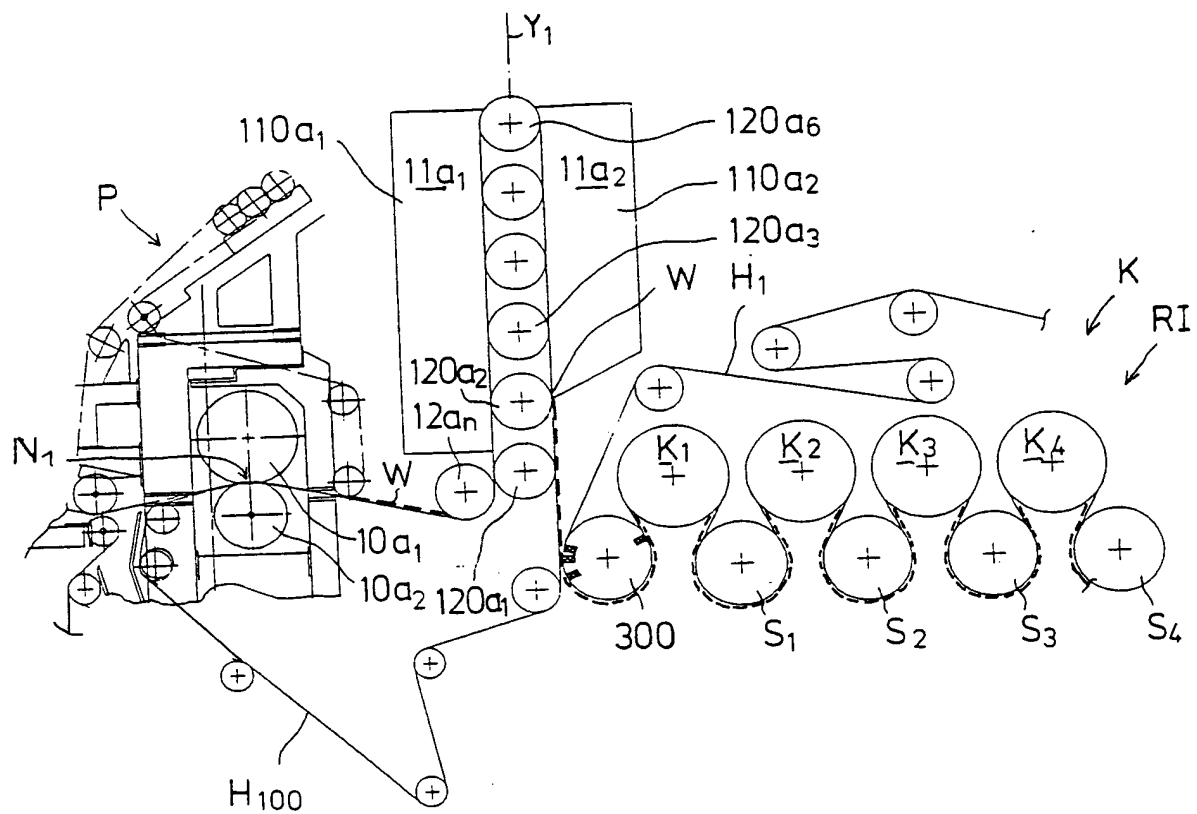


FIG. 12

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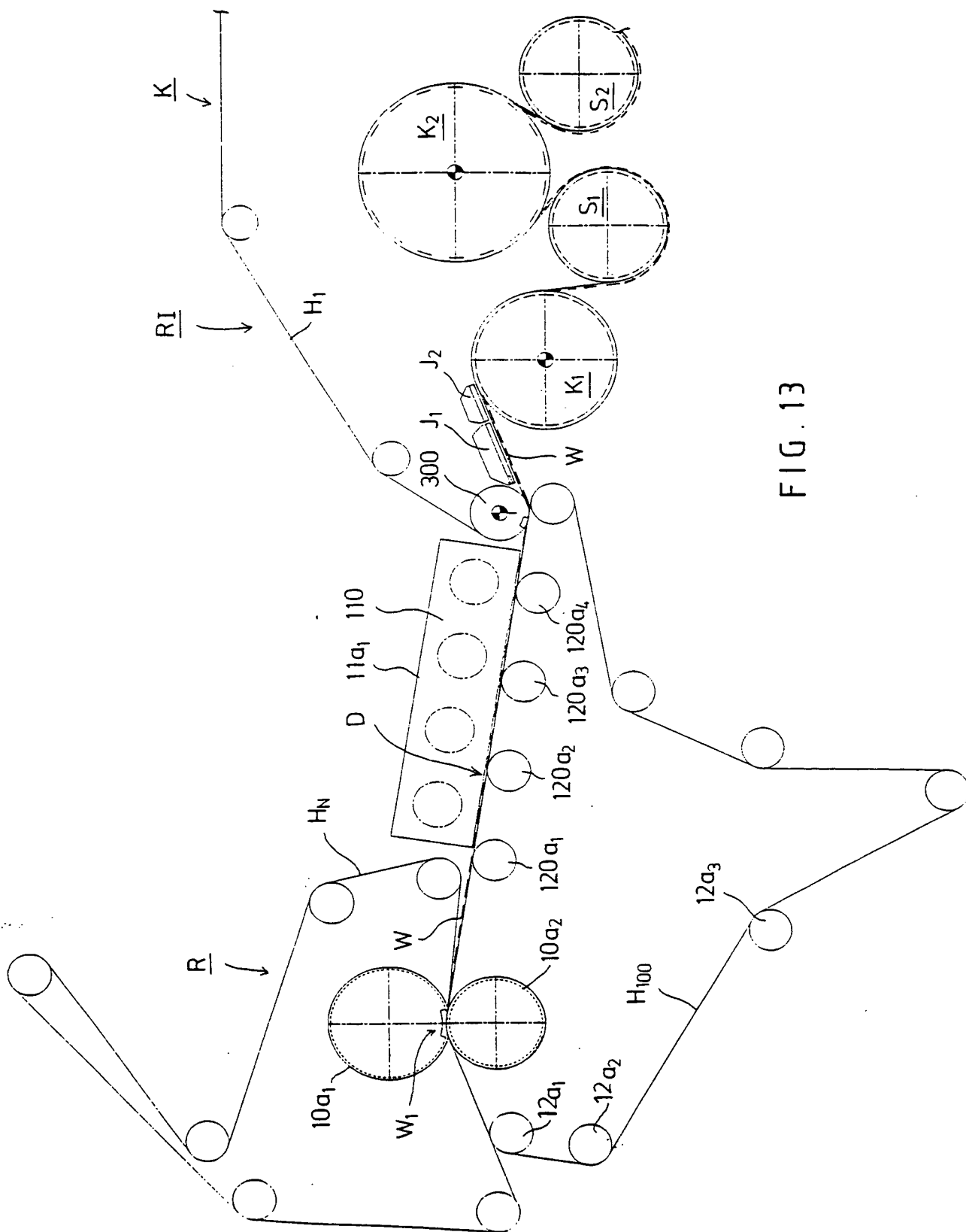
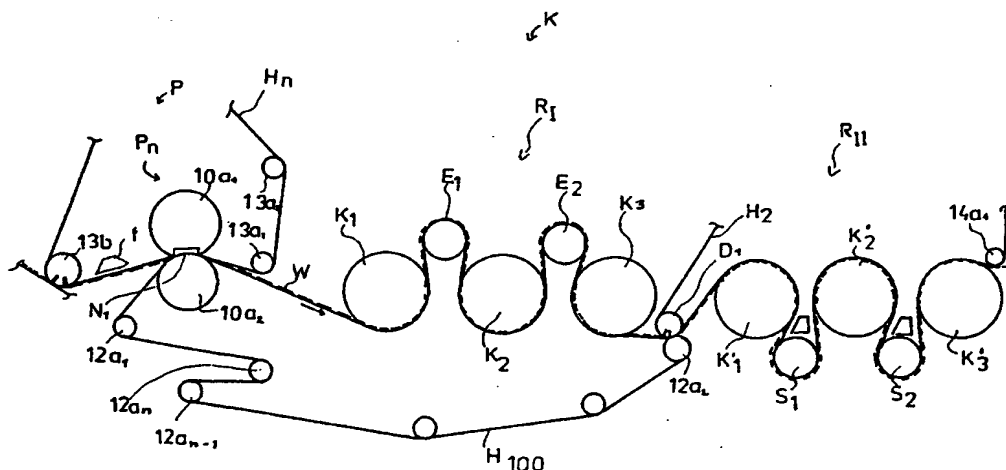


FIG. 13

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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<p>(21) International Application Number: PCT/FI98/00446</p> <p>(22) International Filing Date: 28 May 1998 (28.05.98)</p> <p>(30) Priority Data: 972302 30 May 1997 (30.05.97) FI</p> <p>(71) Applicant (for all designated States except US): VALMET CORPORATION [FI/FI]; <i>Ranuntie 6, FIN-00620 Helsinki (FI). Fabianinkatu 9A, FIN-00130</i></p> <p>(72) Inventors; and (75) Inventors/Applicants (for US only): ILVESPÄÄ, Heikki [FI/FI]; Anttoninkatu 26 A 3, FIN-40250 Jyväskylä (FI). VESTOLA, Juhani [FI/FI]; Tähtäin 25, FIN-40630 Jyväskylä (FI). JUPPI, Kari [FI/FI]; Hiekkapohjantie 259, FIN-40270 Palokka (FI). KOMULAINEN, Antti [FI/FI]; Tarhiantie 22, FIN-42700 Keuruu (FI).</p> <p>(74) Agent: FORSSÉN & SALOMAA OY; Yrjönkatu 30, FIN-00100 Helsinki (FI).</p>		<p>(81) Designated States: AL, AM, AT, AT (Utility model), AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, CZ (Utility model), DE, DE (Utility model), DK, DK (Utility model), EE, EE (Utility model), ES, FI, FI (Utility model), GB, GE, GH, GM, GW, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (Utility model), SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).</p> <p>Published With international search report. In English translation (filed in Finnish).</p>

(54) Title: DEVICE AND METHOD IN THE TRANSFER OF THE PAPER OR BOARD WEB IN THE PAPER OR BOARD MACHINE



(57) Abstract

The invention concerns an equipment and a method in the transfer of a paper/board web in a paper or board machine. In an embodiment of the invention, the dryer section comprises at least one group of drying cylinders in which, instead of a conventional wire draw, a transfer belt (H₁₀₀) is employed, to which the web (W) is affixed by effect of adhesion and which transfer belt is passed over drying cylinders (K₁, K₂, ...) and reversing rolls (E₁, E₂, ...) and further in said group (R₁) of drying cylinders in the dryer section. The invention also concerns a method in the transfer of the web (W) in the dryer section (K) of a paper/board machine. In an embodiment of the invention, the web (W) is passed, while meandering in loop shape and while adhering to the face of the transfer belt (H₁₀₀), from a drying cylinder (K₁) in the group (R₁) of drying cylinders in the dryer section (K) onto a reversing roll (E₁) and further from the reversing roll onto the next drying cylinder (K₂) and further in the group (R₁) of drying cylinders.

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**Device and method in the transfer of the paper or board
web in the paper or board machine**

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The invention concerns an equipment and a method in the transfer of a paper/board web in a paper or board machine.

- 10 The running of the web in the initial end of the dryer section is often the most critical stage, because the percentage of moisture in the web is still considerably high and the risk of break of the web is then also higher than in the final end of the dryer section. In conventional dryer sections with single-wire draw, thus, the first drying group is, as a rule, the drying group that determines the speed of the whole
- 15 machine. In the prior art, attempts have been made to minimize these problems of runnability by first shifting from twin-wire draw to single-wire draw, by developing various devices that stabilize the run of the web, such as, for example, UR blow boxes, and by substituting for the reversing cylinders in the single-wire draw by suction rolls, such as, for example, Vac rolls. Further, in order to provide a more
- 20 efficient support, the vacuum levels in the suction rolls have been increased, which, of course, increases the consumption of energy in the paper machine. As is known from the prior art, attempts have also been made to reduce the problems of runnability in the initial end of the dryer section by, in the beginning of the dryer section, fitting a substantially horizontal wire draw on which the web is dried by
- 25 blowing hot air against the web. One problem in this solution is the space taken by the impingement drying arrangements. In the present patent application, it is suggested that, at least in the first drying group, in stead of an ordinary drying wire, a so-called transfer belt is employed, which is such a belt element that transfers the web whose face is smooth and whose adhesion properties are good. The web adheres
- 30 to the face of the transfer belt. Further, the transfer belt is impenetrable by air and water. When a transfer belt in accordance with the invention is used, no separate web support blowing or equivalent is needed, but the transfer belt alone operates as

an element that transfers and affixes the web. Owing to the belt, the running of the web is stable. Owing to said web affixing property, the web remains on the face of the transfer belt also on curved runs of the web. In a group of drying cylinders with single wire draw and provided with a transfer belt, it is, thus, not necessary to
5 employ so-called suction rolls as reversing cylinders.

When the speeds of paper machines become higher, said problems of runnability, in particular in the beginning of the dryer section, are emphasized. With increasing running speeds, it has become necessary to avoid open draws of the web also
10 between the press section and the dryer section. As is known from the prior art, it has been suggested that said draw is closed, among other things, by picking up the web directly from the face of a press roll by means of a suction roll onto a drying wire. Also, in a way known from the prior art, a transfer belt has been used in the press section, which belt does not receive water and does not wet the web and from
15 which belt the web has been picked up as a closed draw onto the drying wire of a cylinder group or directly onto the face of the first cylinder. Said technique has not yet become very common. One potential problem is the transfer of the web from the transfer belt to the dryer section, and an embodiment of the present invention attempts to reduce this problem.

20 In view of avoiding the problems mentioned above, in the method in accordance with the present invention, the web is made to adhere to the outer face of a transfer belt substantially not receiving water in the press section, for example in its last press nip, and the web is passed as a closed draw into the dryer section.

25 Thus, the solution in accordance with the invention includes a transfer belt loop, which does substantially not receive water and whose outer face is capable of adhering to the paper web and which has been fitted to run as a continuous loop at least through the last press in the press section and further over drying cylinders.

30 The transfer belt H_{100} is favourably of the type described in the *US Patent 5,298,124*.

By means of the method and the concept of equipment in accordance with the present invention, it is possible to accomplish improved properties of smoothness of the faces of paper or board to be manufactured and more stable running of the web, which is partly based on the use of a transfer belt which has a relatively smooth face and which is applied and arranged in accordance with the present invention.

The invention is usable with further increasing running speeds in new machines, but it also offers an easy mode of improving the runnability in the initial part of the dryer section in existing paper machines. An existing wire is substituted for by a transfer belt in accordance with the invention.

The invention is characterized in what is stated in the patent claims.

In the following, the invention will be described in detail with reference to some exemplifying embodiments of the invention illustrated in the figures in the accompanying drawings, the invention being by no means strictly confined to the details of said embodiments.

Figure 1 shows a construction of a dryer section in accordance with the invention, which comprises a transfer belt draw in stead of a conventional single-wire draw, which transfer belt draw preferably extends to the press, i.e. runs through a press nip.

Figure 2 shows a dryer section provided with a transfer belt draw, comprising impingement drying units in connection with drying cylinders and reversing rolls, through which units a drying medium is supplied to increase the drying capacity.

Figure 3A shows a conventional prior-art single-wire draw arrangement which is used in a dryer section concept in accordance with the invention in its second group R_{II} of drying cylinders.

Figure 3B shows a transfer belt draw in accordance with the invention employed in the first group R_I of drying cylinders. The embodiment shown in Fig. 3B corresponds to Fig. 2, in which impingement drying units have been fitted in connection with the drying cylinders and with the reversing rolls.

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Figure 4 shows an embodiment of the invention in which the web W is passed out of connection with the face of the backup roll of the extended-nip roll in an extended-nip press by means of an adhesion nip onto a transfer roll and further into connection with a transfer belt in accordance with the invention in the group of drying cylinders.

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Figure 5 shows an embodiment of the invention in which the web is passed from the face of the backup roll of an extended-nip roll directly into connection with a transfer belt.

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Figure 6A shows an embodiment of the invention in which the web is passed into the first group of drying cylinders in the dryer section from the face of a press felt.

Figure 6B shows an embodiment of the invention in which the web is passed into a group of drying cylinders in the dryer section from the face of a centre roll in the press by bringing the transfer belt into contact with the face of the centre roll in the press.

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Figure 7A shows the transfer of the web from the group R_I of drying cylinders into the following group R_{II} of drying cylinders by, between the groups, employing a separate transfer suction roll and a transfer fabric.

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Figure 7B shows an embodiment of the invention in which exclusively a transfer suction roll is employed between the groups R_I and R_{II} of drying cylinders.

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Figure 8 shows an embodiment of the invention in which the transfer belt of a group of drying cylinders has been fitted to run through a press nip and in which, in the

first group R_I of drying cylinders, the drying cylinders are placed in upper positions and the reversing rolls in lower positions, and in which solution the web is transferred from the first group R_I of drying cylinders into a group R_{II} of drying cylinders provided with twin-wire draw.

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Figure 9A shows an embodiment of the invention in which the transfer belt is passed from the last press in the press section through a press nip so that, inside the loop of the transfer belt, there is a large-diameter roll, along with whose face two impingement drying units and their impingement hoods have been fitted.

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Figure 9B shows an embodiment of the invention which is in the other respects similar to the embodiment shown in Fig. 9A, but in the embodiment of Fig. 9B, before the what is called impingement drying roll, an impingement drying unit is placed, by whose means pre-heating of the web is carried out before the impingement drying roll proper.

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Figure 10 shows an embodiment that is in the other respects similar to Fig. 9A, but in the embodiment shown in Fig. 10, the what is called impingement drying roll has been substituted for by a roll with an even larger diameter in order to increase the length of the impingement drying zone.

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Figure 11 shows an embodiment of the invention in which the what is called impingement drying roll has been substituted for by an oblong impingement drying hood. The impingement drying unit has been fitted in connection with a linear run of the transfer belt, and after the impingement drying unit the web is transferred from the transfer belt into the first group of drying cylinders in the dryer section.

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Figure 12 shows an embodiment in the other respects similar to Fig. 11, but in the solution of Fig. 12 the length of the impingement drying zone has been increased by fitting the support rolls in a vertical stack, in which case the web and the run of the transfer belt run first along with the support rolls upwards and from the last support

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roll along with the corresponding support rolls downwards. Impingement drying units have been fitted at both sides of the support rolls.

Figure 13 shows a construction in the other respects similar to Fig. 11, but in this embodiment the beginning of the dryer section K includes suction boxes right after the transfer suction roll.

In the construction shown in Fig. 1, the single-wire draw has been substituted for by a transfer belt draw. Further, in the dryer section concept shown in Fig. 1, besides through the first group R_I of drying cylinders in the dryer section K, the transfer belt H_{100} also runs through the press section P. The transfer belt H_{100} runs as a closed loop through the nip N_1 between the press rolls $10a_1, 10a_2$ in the press P_N . In the solution in accordance with the invention, in the way shown in Fig. 1, the paper or board web W adheres, in the nip N_1 between the press rolls $10a_1$ and $10a_2$ in the press 10, to the transfer belt H_{100} passed through the press nip N_1 and runs on the face of the transfer belt into the dryer section K to its first group R_I of drying cylinders. Thus, the transfer belt H_{100} has been passed at least through the last press nip N_1 in the press P_N in the press section P. The web is passed to the press P_N by means of the suction of the pick-up roll 13b so that the web is first transferred onto a transfer felt H_N and kept along with the face of the felt by means of the holding suction produced by a blow box f. Thus, the transfer felt H_N has been passed through the nip N_1 and guided by the felt guide rolls $13a_1, 13a_2 \dots$. The press P_N is preferably an extended-nip press, whose upper roll $10a_1$, as is shown in Fig. 1, is a so-called extended-nip roll and comprises a resilient belt mantle of an extended-nip roll. The upper extended-nip roll $10a_1$ in the extended nip comprises a loading shoe, which is pressed towards the backup roll, in which connection the resilient belt mantle complies with the face form determined by the loading shoe. From the drying group R_I the web W is transferred to the second drying group R_{II} , which is conventional, i.e. comprises a conventional single-wire draw with a conventional wire H_2 . The wire H_2 is guided as a closed loop over the wire guide rolls $14a_1, 14a_2$. It should, however, be emphasized in this connection that the invention is also usable in connection with other prior-art press solutions, besides in connection with an

extended-nip press. The press may advantageously also consist of more than one dewatering press nips.

5 A significant drawback of the press felts that have been employed in prior-art press sections has been an effect of rewetting the web and a tendency of contamination. A transfer belt H_{100} in accordance with the invention does substantially not receive water, is impenetrable by air, smooth, and its outer face is capable of adhering to the paper web. In such a case, the paper web can be made to adhere to the outer face of the transfer belt loop without rewetting of the web. On the transfer belt the web (paper or board web) can be passed as a closed and supported draw from the 10 press to the dryer section K to the first drying group R_I in the dryer section and from said group into the conventional group R_{II} of drying cylinders provided with single-wire draw, which group comprises conventional suction rolls S_1, S_2, \dots of the VacRoll type.

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From the nip N_1 formed by the press rolls $10a_1$ and $10a_2$, which nip is preferably an extended nip, the web is carried on the top face of the transfer belt H_{100} onto the first drying cylinder K_1 in the first group R_I of drying cylinders in the preliminary dryer section, i.e. in the dryer section K, which cylinder K_1 is a steam-heated drying 20 cylinder. The web W runs further along the face of the drying cylinder K_1 between the transfer belt H_{100} and the face of the drying cylinder K_1 further onto an ordinary reversing roll E_1 and remains in contact with the face of the transfer belt H_{100} also in connection with the reversing roll E_1 , which is an ordinary, non-heated roll construction. The transfer belt H_{100} has been passed, besides over the drying cylinders K_1, K_2, \dots and over the reversing rolls E_1, E_2 and through the nip N_1 , also over 25 the transfer belt guide rolls $12a_1, 12a_2, \dots, 12a_N$. The web W runs meandering in loop shape in the group R_I of drying cylinders in the dryer section, i.e. from the reversing roll E_1 further onto the second heated drying cylinder K_2 in the group R_I and further in the group R_{II} of drying cylinders. Thus, in the drying group R_I , the reversing rolls E_1, E_2, \dots, E_n can be ordinary smooth-faced rolls. The rolls may also 30 have grooved faces. They do not need inside suction or perforations, by whose means, in a conventional dryer section provided with single-wire draw, the web W

is affixed at the suction cylinders to the wire face. The properties of the transfer belt H_{100} are such that the web W remains in contact with the face of the transfer belt also in the loop-shaped meandering web run formed by conventional reversing rolls E_1, E_2, \dots not provided with suction. Out of connection with the drying cylinder K_3 ,
5 the web W is transferred further onto the transfer suction roll D_1 in the second drying group R_{II} . Being transferred by means of the suction of the transfer suction roll D_1 , the web W is separated from the transfer belt H_{100} and is transferred further, out of connection with the face of the transfer belt H_{100} , into connection with the wire H_2 in the second group R_{II} of drying cylinders in the dryer section K
10 and further in said conventional group R_{II} of drying cylinders.

In the beginning of the dryer section, the strength of the web W is lowest, because the water content in the web is still high. Thus, as a rule, the beginning of the dryer section has determined the maximal speed at which it has been possible to run the
15 paper/board machine. Thus, as a rule, the first drying group R_I has determined the maximal speed of the dryer section and, thus, also of the whole paper/board machine. When a transfer belt H_{100} is used in the first group R_I of drying cylinders in the dryer section K , the speed of the whole paper/board machine can be increased to a significant extent. When a transfer belt H_{100} is employed in stead of a conven-
20 tional wire, it is possible to stabilize and to speed up the draw of the web to a considerable extent in the initial end of the dryer section. When a transfer belt H_{100} is used, the run of the web W is stable and steady, and there is no risk of web break. The web W is transferred as a closed draw from the press into the dryer section into its group R_I of drying cylinders and from said group into the second
25 group R_{II} . There are no open web draws in the first group R_I of drying cylinders in accordance with the invention in the dryer section K .

As is shown in Fig. 1, the web is passed from the preliminary dryer section in accordance with the invention, i.e. from the first drying group R_I in accordance with
30 the invention, to the second group R_{II} of drying cylinders in the dryer section, which group is a conventional group of drying cylinders provided with single-wire draw, in which the wire has been fitted to run over conventional suction rolls S_1, S_2, \dots of

the VacRoll type. The suction rolls $S_1, S_2 \dots$ comprise a perforation passing through the roll mantle and opening into the grooves placed on the mantle face of the roll, on one hand, and into the interior of the roll, on the other hand, and a vacuum is applied to the roll interior. In such a case, a suction and holding force can be applied to the grooves provided in the circumferential direction on the face of the roll mantle and, further, to the web W that is passed outside. The wire is a conventional fabric permeable to air and used in single-wire draw. Even though, in Fig. 1, the group R_{II} is a normal group with single-wire draw, in some cases, in particular in modernizations by whose means attempts are made expressly to eliminate problems of runnability in the beginning of the dryer section, in accordance with the present invention, the group R_{II} may also be a drying group of a different type, for example a Uno-Run group or even a group with twin-wire draw.

In traditional cylinder drying, in the first group, just very little evaporation of water present in the web takes place through the wire. This is why, employment of a belt impenetrable by air and water in compliance with the present invention does not reduce the drying efficiency to a substantial extent. On the contrary, as the web follows the belt reliably, the temperature of the cylinders can be raised without a risk that the web might follow the cylinder face. If it is desirable to increase the drying capacity further, it is possible to use an arrangement in accordance with Fig. 2.

In view of increasing the drying capacity, the group R_I of drying cylinders in the dryer section shown in Fig. 2 is additionally provided with impingement drying boxes $11a_1, 11a_2 \dots$ placed in connection with the reversing cylinders $E_1, E_2 \dots$, through which boxes hot air / hot gas / hot steam is blown into connection with the web W in order to increase the drying capacity. The construction of the dryer section shown in Fig. 2 is in other respects similar to the construction of the dryer section shown in Fig. 1. In a solution of equipment in accordance with the invention, the impingement drying units can be placed either exclusively in connection with steam-heated drying cylinders or, as is shown in Fig. 2, also in connection with the reversing cylinders $E_1, E_2 \dots$. In principle, similar impingement drying can also be

arranged in connection with the drying cylinders K_1, K_2, \dots , but its capacity remains low because of the impenetrable belt.

Fig. 3A shows a prior-art conventional single-wire draw which is employed in the group R_{II} of drying cylinders, i.e. in the second group of drying cylinders. An ordinary drying wire H_2 has been passed from the drying cylinder K_1' onto the suction roll S_1 and from the suction roll S_1 onto the second drying cylinder K_2' and further in the group R_{II} of drying cylinders. As is shown in the figure, the suction cylinder S_1 comprises grooves u_1, u_2 on its face, in which grooves the holes a_1, a_2 passing through the mantle S' of the suction cylinder terminate. A vacuum is applied to the interior of the suction cylinder, by whose means a circumferential holding force can be applied to the web W . In the way shown in Figs. 1 and 2, blow boxes B_1 and B_2 or equivalent apparatuses that stabilize the running of the web can also be fitted in the pockets formed by the cylinders and by the suction roll.

The dryer section concept in accordance with the invention can comprise a number of groups $R_{II}, R_{III}, R_{IV}, \dots$ drying cylinders, which groups are, after the first group of drying cylinders, ordinary groups of drying cylinders provided with single-wire draw. A transfer belt can also be employed in other groups of drying cylinders besides in the first group of drying cylinders.

Fig. 3B is an axonometric illustration of a group R_I as shown in Fig. 2, wherein both the drying cylinders and the smooth-faced reversing cylinders are provided with impingement drying units $11a_1, 11a_2, \dots$, through which a heat transfer medium, preferably steam or hot air, is passed into connection with the web W . As is shown in the figure, the reversing rolls E_1, E_2, \dots are smooth-faced reversing rolls. The transfer belt H_{100} has been passed over the smooth, non-perforated roll faces e of the reversing rolls E_1, E_2, \dots

In the following Figs. 4 to 8, different modes of transfer of the web to the dryer section K and from the first group of drying cylinders in the dryer section to the second group of drying cylinders will be illustrated. However, it is an essential

feature of all of the embodiments to be described in the following that at least the group R_I of drying cylinders is a drying group provided with a transfer belt H_{100} similar to what has been described above in relation to Fig. 1.

5 Fig. 4 shows an embodiment of the invention in which, similarly to the embodiment shown in Fig. 1, the group R_I of drying cylinders in the dryer section K consists of drying cylinders K_1, K_2, K_3 and reversing cylinders E_1, E_2 and E_3 . As is the case in the embodiment shown in Fig. 1, the drying cylinders K_1, K_2, K_3 are steam-heated smooth-faced drying cylinders, and the reversing cylinders E_1, E_2, \dots are conventional smooth-faced rolls. In the embodiment shown in the figure, between the drying groups R_I and R_{II} , there is a smooth-faced roll K_{10} , which may also be a cylinder, such as a drying cylinder. In accordance with the invention, the group R_I includes a transfer belt H_{100} , and, as is shown in the figure, the web W is transferred, meandering in loop shape, along with the transfer belt H_{100} , to which the web adheres by means of adhesion, further in the group of drying cylinders. The web is transferred into the group R_I of drying cylinders from the press P_N out of connection with the press rolls $10a_1$ and $10a_2$, which are preferably rolls in an extended-nip press. As is shown in the figure, the web W is transferred further, adhering to the smooth face of the upper backup roll $10a_2$ of the smooth-faced extended-nip roll $10a_1$, by means of an adhesion nip V, onto the upper transfer roll S_{100} , for example a suction roll, and from its connection into connection with the transfer belt H_{100} , to whose face the web W adheres. From the group R_I the web is transferred into connection with the cylinder or smooth-faced roll K_{10} and further into connection with the second drying group R_{II} between the wire H_2 and the cylinder K_{10} and further in the group R_{II} . The group R_{II} can be a conventional group of drying cylinders with single-wire draw, in which, between the drying cylinders, there are VacRoll rolls S_1, S_2, \dots , as is the case also in the embodiment shown in Fig. 1. In this embodiment, the adhesion nip V may also operate as a so-called equalizing press, by whose means substantially the same smoothness is achieved for both faces of the web.

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Fig. 5 shows an embodiment of the invention in which the group R_I of drying cylinders in the dryer section comprises a transfer belt H_{100} , as is the case in the preceding embodiments, but in which solution the web W is picked up into connection with the transfer belt H_{100} out of connection with the press P , preferably out of connection with the backup roll $10a_2$ of the extended-nip roll $10a_1$ of an extended-nip press. After the nip N_1 in the press P_N , the web W moves a certain distance on the face of the backup roll $10a_2$ of the press P_N , which roll is preferably a smooth-faced roll, and reaches contact with the transfer belt H_{100} , which has been brought into connection with said roll face, and adheres to the belt. In the embodiment of the figure, the guide roll $12a_n$ has been fitted in such a way in connection with the lower roll $10a_2$ of the press P_N that the roll $12a_n$ presses the transfer belt H_{100} into contact with the lower roll $10a_2$ of the press P_N . Thus, as is shown in the figure, the web W is transferred along with the transfer belt H_{100} , meandering in loop shape, over the drying cylinders K_1, K_2, \dots and the conventional smooth-faced reversing rolls E_1, E_2, \dots , in the same way as in the embodiment shown in Fig. 1, in the group R_I onto the transfer suction roll S_{100} , which is placed between the groups R_I and R_{II} and which may comprise a wire sock on its face, in which connection a suction effect is applied to the web W in the position between the groups. In this way the web is transferred from the group R_I to the group R_{II} , which may be a conventional group of drying cylinders with single-wire draw which includes Vac rolls S_1, S_2, \dots

Fig. 6A shows an embodiment of the invention in which the web W is passed from the press P to the dryer section K into its first group R_I of drying cylinders, which comprises a transfer belt H_{100} as described above. In the embodiment of Fig. 6A, the web W is passed, while adhering to the transfer belt H_{100} , from the drying cylinder K_1 onto the smooth-faced reversing roll E_1 and further onto the drying cylinder K_2 placed in a different position of height, and further in the group of drying cylinders. Thus, the web is kept in contact with the face of the transfer belt H_{100} constantly while the web adheres to the transfer belt by means of adhesion. Thus, Vac Rolls or equivalent are not needed, and blow boxes and equivalent are likewise not needed. From the press P_N , out of the nip N_1 , the web W is passed in between the press felts H_N and H_{N+1} . The web W is transferred from the felt H_N

onto the transfer belt H_{100} of the group R_I , as is the case in the embodiment shown in Fig. 1, and from the group R_I into the group R_{II} , which group R_{II} can be, as is shown in the figure, for example, a twin-wire group comprising the wires H_{200}, H_{201} . Thus, from the group R_I of drying cylinders the web is transferred, for example, into a conventional twin-wire group R_2 by means of a transfer suction roll D_{10} . Thus, the group R_{II} of drying cylinders comprises conventional wires H_{200}, H_{201} and drying cylinders K_1', K_1'' and K_2', K_2'' ...

Fig. 6B shows an embodiment in which the web is transferred into the first group R_I of drying cylinders in the dryer section K out of connection with the centre roll 50 of the press section P. As is shown in the figure, the web W is brought through the nip N_{10} into connection with the centre roll 50 and transferred on the face of the centre roll into the second press nip N_{20} and further, along the face 50' of the centre roll 50, through the press nip N_2 and further from the face 50' of the centre roll 50 into connection with the transfer belt H_{100} of the group R_I , which transfer belt H_{100} has been brought into contact with the face of the centre roll 50 by means of the roll T. As is shown in the figure, the group R_{II} may be, for example, a group with twin-wire draw or, as is shown in Fig. 1, an ordinary group with single-wire draw. The group R_I is of the same sort as the group R_I in Fig. 1. The group R_{II} is similar to that shown in the embodiment of Fig. 6A. It is obvious that the group can also be an ordinary group of drying cylinders with single-wire draw. The felt draws in the press P have been denoted with H_{n+2} and H_{n+3} .

Fig. 7A shows a separate transfer fabric loop H_{300} , which is placed between the groups R_I and R_{II} and which has been passed over the suction roll S_{200} , which suction roll S_{200} is placed between the groups R_I, R_{II} . The web W is transferred out of connection with the transfer belt H_{100} of the group R_I into connection with the transfer wire H_3 and further into the second drying group R_{II} . In the embodiment shown in the figure, the group R_I comprises the transfer belt H_{100} , the smooth-faced reversing cylinders E_1 and E_2 , and the drying cylinders K_1, K_2 ... As is shown in the embodiment shown in Fig. 1, the web runs, adhering to the transfer belt H_{100} , up to the end of the group R_I , where the web W is separated from the face of the

transfer belt H_{100} by means of the transfer wire H_3 and the transfer suction roll S_{200} , the web being transferred along with the transfer wire H_3 into the second group R_{II} of drying cylinders, which may be a conventional group with single-wire draw, the web being brought first into vicinity of the transfer suction roll S_1 in said group, and being transferred further in a conventional group R_{II} of drying cylinders provided with single-wire draw H_1 .

Fig. 7B shows an embodiment which is in the other respects similar to that shown in Fig. 7A, but in which there is no separate loop of transfer wire H_3 and in which the web is picked up exclusively by means of the transfer suction roll S_{300} from the transfer belt H_{100} of the first group R_I into the second group R_{II} of drying cylinders.

Fig. 8 shows an embodiment that is in other respects similar to Fig. 1, but in which embodiment the second group R_{II} of drying cylinders is a conventional group of drying cylinders with twin-wire draw. The group of drying cylinders in Fig. 8 additionally differs from the embodiment shown in Fig. 1 in the respect that, in the embodiment of Fig. 8, the reversing rolls E_1, E_2 are placed in the lower position in relation to the drying cylinders K_1, K_2, K_3 . In the end of the group R_I , the web W is picked up from the face of the transfer belt H_{100} by means of a transfer suction roll D_{10} , which is placed inside the lower wire loop H_{200} of the second group R_{II} of drying cylinders.

In the embodiments described above in relation to Figs. 4...8, it is obvious that, in connection with the reversing rolls E_1 placed after the drying cylinders, it is additionally possible to fit impingement drying apparatuses, as is illustrated in Figs. 3A and 3B.

In the solution shown in Fig. 9A, in the last press nip, in the place of the lower felt there is a transfer belt H_{100} (TransBelt). Normally the web W is separated from the transfer belt H_{100} directly after the press, but in the solution in accordance with the present invention the web is passed over a turning roll or drying cylinder onto an impingement drying roll. Since, after pressing, the web adheres tightly to the face

of the transfer belt, the web need not be supported in any way during the impingement drying. After the impingement drying unit the web is transferred onto the first drying cylinder, and the drying is continued normally with single-wire draw.

- 5 The turning roll or the drying cylinder $12a_n$ of the transfer belt H_{100} can be coated if steel, rubber, or flake graphite cast iron causes problems of adhesion. A second possibility is to employ such a high steam pressure in the cylinder that a film of steam is formed between the web and the cylinder, in which case the web does not adhere to the face of the cylinder.

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The roll 100 that is provided with impingement drying units $11a_1$, $11a_2$ can be a smooth roll in this case. On the roll, impingement drying is applied to the web, in which connection the dry solids content of the web becomes higher before the transfer to the geometry with single-wire draw. The hoods of the impingement drying units are denoted with $130a_1$, $130a_2$. In them, the discharge faces for the impingement drying medium, such as air, are placed in the vicinity of the web W, while the web W follows the face of the transfer belt H_{100} along with the face of the roll 100.

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- 20 Fig. 9A shows the use of the transfer belt H_{100} in connection with the last press $10a_1$, $10a_2$ in the press P, which last press is preferably an extended-nip press, which comprises an extended-nip roll $10a_1$, which is provided with a resilient belt mantle which adapts itself to the shape of the preferably smooth-faced backup roll $10a_2$ while the extended-nip roll is provided with a loading shoe connected with its central axle and placed inside the belt mantle, the shape of the loading face of said loading shoe corresponding to the shape of the face of the backup roll.

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In accordance with the invention, the transfer belt H_{100} , to which the web adheres in the nip N_1 , is transferred further to the impingement drying units $11a_1$ and $11a_2$, which have been fitted in the vicinity of the face of the large-diameter roll 100. In the embodiment shown in Fig. 9A, the diameter of the roll 100 is 3600 mm, in which case the length of the impingement drying zone is 7.9 metres. The whole

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impingement drying assembly in the embodiment of Fig. 9A consists of two parts and comprises the impingement drying units $11a_1$ and $11a_2$. Through each impingement drying unit $11a_1$, $11a_2$, a heat transfer medium, such as warm air or steam, is blown into connection with the web W in order to dry the web.

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As is shown in the figure, the transfer belt H_{100} is passed over the alignment rolls $12a_3, 12a_4 \dots$. The upper felt H_N is also passed through the press nip N_1 of the extended-nip press and guided by means of the alignment rolls $13a_1, 13a_2 \dots$. From the transfer belt H_{100} the web W is transferred over the transfer suction roll 300 into the first drying group R_1 in the dryer section K, which group is provided with a conventional run H_1 of a drying wire.

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The group R_1 of drying cylinders in the dryer section K comprises drying cylinders $K_1, K_2 \dots$ and suction cylinders $S_1, S_2 \dots$ (of the VacRoll type). The dryer section K is a conventional construction of a dryer section. It comprises preferably several groups of drying cylinders, but it is an essential feature of the whole construction that the transfer belt H_{100} is placed in the construction so that, by its means, the paper or board web W is transferred from the press section P to the dryer section K.

15

Example of measures for the geometry shown in Fig. 1 (roll diameter 3600 mm):

20

- running speed 2000 metres per minute
- rate of evaporation 120 kg (per square metre in an hour)
- diameter of impingement drying roll 3.6 m (coverage 215 degrees)
- increase in dry solids content $45 \rightarrow 48.5 \%$.

25

An increase of 3.5 % in the dry solids content means a considerable improvement in the properties of strength of the web, and the transfer of the web from the cylinder further at this dry solids content is already considerably more reliable than at a dry solids content of 45 %.

30

In Fig. 9B, in the geometry in accordance with the invention, it is also possible to use an additional impingement drying unit 500 before the turning roll $12a_n$, in which

case the impingement drying would take place on a plane. This solution would provide the advantage that the temperature of the web can be raised before the impingement drying proper. Depending on the length of the unsupported draw, the transfer belt H_{100} can be supported from below, for example, by means of a sufficient number of support rolls $120a_1, 120a_2...$

Fig. 10 shows an embodiment in the other respects similar to Fig. 9A, but in the embodiment of Fig. 10 the roll 100 has an even larger diameter of 4800 mm, as compared with that shown in the solution of Fig. 9A. In such a case, the length of the impingement drying zone becomes 10 metres. Correspondingly, the increase in the dry solids content produced by the impingement drying is higher than in the solution shown in Fig. 9A.

Fig. 11 shows an embodiment of the invention in which the roll 100 has been substituted for by an oblong impingement drying hood 110 of the impingement drying unit $11a_1$. The run of the transfer belt H_{100} is in the other respects similar to that in the embodiments shown in Figs. 9 and 10. In this embodiment, the run of the transfer belt H_{100} comprises a straight linear run portion D_1 between the last press in the press section P, which last press is preferably an extended-nip press, and the first drying group R_1 in the dryer section K. The support rolls $120a_1, 120a_2, 120a_3, 120a_4, 120a_5$ support the run of the transfer belt H_{100} , and the oblong hood 110 of the impingement drying unit has been fitted on the run D_1 in the embodiment shown in the figure. The length of the impingement drying zone is about 10 metres. In such a case, a considerable drying capacity is achieved. In the way shown in the figure, by means of the suction roll 300 the web is transferred from the face of the transfer belt H_{100} onto the face of the drying wire H_1 of the first drying group R_1 in the dryer section K, and further in the dryer section K.

In Fig. 12, an embodiment is shown which is in the other respects similar to Fig. 11, but in the embodiment of Fig. 12 the impingement drying length has been increased by fitting the support rolls $120a_1, 120a_2...$ vertically and by fitting impingement drying units $11a_1$ and $11a_2$ at both sides of the support rolls $120a_1, 120a_2...$

- The support rolls $120a_1, 120a_2 \dots$ are placed so that their axles are placed in a vertical plane Y_1 , and the transfer belt H_{100} is passed along the support rolls $120a_1, 120a_2 \dots$ first upwards and, around the last support roll in the vertical stack and after said roll downwards along the corresponding support rolls $120a_1, 120a_2 \dots$
- 5 Thus, at each side of the support rolls $120a_1, 120a_2 \dots$, there are impingement drying units $11a_1, 11a_2$, through which warm air, steam or some other heating medium is blown into connection with the web W in order to dry the web. The hoods $110a_1, 110a_2 \dots$ of the impingement drying units $11a_1, 11a_2$ are oblong constructions.
- 10 Further, in Fig. 12, a solution is suggested in which the web runs along a linear path by means of a belt upwards (may also take place downwards). It is an advantage of the solution of Fig. 12 that the dryer section becomes considerably shorter in the longitudinal direction. In stead, more space is required in the direction of height.
- 15 Fig. 13 shows a construction similar to Fig. 11. The embodiment shown in this figure differs from the embodiment shown in Fig. 1 in respect of the construction of the inlet side of the drying group R_1 in the dryer section K . The initial part of the dryer section K comprises suction boxes J_1, J_2 after the suction cylinder M .
- 20 Even if, in Figs. 11, 12 and 13, linear long transfer belt draws are illustrated, the invention is not confined to such draws alone, but the transfer belt draw may also be curved if such a shape is preferable in view of the machine geometry, the belt tension to be maintained, or the runnability, or in view of an equivalent factor.

Claims

1. An equipment in the transfer of a paper/board web (W) in a paper or board machine, **characterized** in that, in the transfer of the web (W), a transfer belt (H_{100})
5 is employed, to which the web (W) is affixed by the effect of adhesion and which transfer belt is passed in such a way in connection with the paper/board machine that it is in contact with a roll ($10a_1$ or $10a_2$ or S_{100}) that forms the press nip of the last press in the press section (P), and that the web (W) is passed from the press, while it adheres to the transfer belt (H_{100}), further, and that thermal energy is supplied to
10 the web while the web adheres to the transfer belt (H_{100}).
2. An equipment as claimed in claim 1 in the transfer of a web (W) in a paper or board machine, **characterized** in that the dryer section comprises at least one group of drying cylinders in which, in stead of a conventional wire draw, a transfer belt
15 (H_{100}) is employed, to which the web (W) is affixed by the effect of adhesion and which transfer belt is passed over drying cylinders (K_1, K_2, \dots) and reversing rolls (E_1, E_2, \dots) and further in said group (R_1) of drying cylinders in the dryer section.
3. An equipment as claimed in claim 1 in the transfer of a web (W) in a paper or
20 board machine, **characterized** in that there is a transfer belt (H_{100}) at least in the first group (R_1) of drying cylinders in the dryer section.
4. An equipment as claimed in any of the preceding claims in the transfer of a web (W) in a paper or board machine, **characterized** in that the transfer belt (H_{100}) is
25 impenetrable by air and water.
5. An equipment as claimed in any of the preceding claims in the transfer of a web (W) in a paper or board machine, **characterized** in that the reversing rolls (E_1, E_2, \dots) are smooth-faced rolls and that the web (W) runs at the rolls (E_1, E_2, \dots) while trans-
30 ferred by the transfer belt (H_{100}) and remains on the face of the transfer belt (H_{100}) by the effect of the adhesion force applied by the transfer belt (H_{100}) to the web.

6. An equipment as claimed in any of the preceding claims in the transfer of a web (W) in a paper or board machine, **characterized** in that the transfer belt run, which has been passed as a closed loop in the first group (R_I) of drying cylinders in the dryer section, has been passed additionally at least through the press nip (N_1) formed
5 between the press rolls ($10a_1, 10a_2$) in the last press (P_N) in the press section (P), in which connection the web (W) adheres to the transfer belt (H_{100}) in the press nip (N_1), and the transfer of the web from the press into the dryer section into its first group (R_I) of drying cylinders is a so-called closed web draw supported by the transfer belt (H_{100}).
- 10 7. An equipment as claimed in any of the preceding claims in the transfer of a web (W) in a paper or board machine, **characterized** in that, after the group (R_I) of drying cylinders provided with a transfer belt (H_{100}), the dryer section (K) comprises a second group (R_{II}) of drying cylinders, into which the web (W) is transferred as a closed draw, and which second group (R_{II}) of drying cylinders comprises
15 a conventional wire draw (H_2), in which connection the web (W) is transferred over drying cylinders and suction rolls ($K_1, S_1, K_2, S_2, \dots$), meandering in loop shape, and kept in connection with the suction rolls (S_1, S_2, \dots) by means of a pressure produced in the interior of the suction rolls.
- 20 8. An equipment as claimed in any of the preceding claims in the transfer of a web (W) in a paper or board machine, **characterized** in that the group (R_I) of drying cylinders which comprises a transfer belt run (H_{100}) is provided with impingement drying units ($11a_1, 11a_2, \dots$), through which a drying medium, preferably steam,
25 heated air or heated gas, is passed into connection with the web (W) in order to increase the drying capacity.
- 30 9. An equipment as claimed in any of the preceding claims in the transfer of a web (W) in a paper or board machine, **characterized** in that the transfer belt (H_{100}) has been passed through the last press nip (N_1) in the press section (P) and so that the transfer belt has been passed over the alignment rolls ($12a_1, 12a_2$), and that, through the nip (N_1), additionally a press felt (H_n) has been passed, the web (W) being

transferred from the nip (N_1) further, while adhering to the face of the transfer belt, and further onto the roll (100), in whose connection at least one, preferably two, impingement drying units ($11a_1, 11a_2$) have been fitted, the paper/board web (W) being dried by means of a heating medium passed from said impingement drying units, and from which roll (100), which is provided with the impingement drying units ($11a_1, 11a_2$), the web (W) is passed, while adhering to the face of the transfer belt (H_{100}), further into connection with the first drying group (R_1) in the dryer section (K).

10 10. An equipment as claimed in claim 1, **characterized** in that the web (W) is passed through the last press nip (N_1) in the press (P), through which nip also the transfer belt (H_{100}) has been passed, the web (W), adhering to the face of said transfer belt, being passed further along a linear run (D_1), in connection with which run support rolls ($120a_1, 120a_2 \dots$) are placed, and an impingement drying unit ($11a_1$)
15 being placed at the opposite side of said run (D_1), which impingement drying unit comprises an oblong hood (110), and that, after the impingement drying unit ($11a_1$), the web is transferred from the face of the transfer belt (H_{100}) into connection with the dryer section (K).

20 11. An equipment as claimed in claim 1, **characterized** in that the transfer belt (H_{100}) has been passed through the press nip (N_1) of the last press ($10a_1, 10a_2$) in the press section (P), and that the web (W), adhering to the face of the transfer belt (H_{100}), is passed on the face of the transfer belt along with the transfer belt run (H_{100}) that is passed vertically along with support rolls ($120a_1, 120a_2 \dots$) upwards, in
25 connection with which run there is an impingement drying unit ($11a_1$), and that, from the last support roll, the web (W) is passed on the face of the transfer belt (H_{100}) downwards into connection with a second impingement drying unit ($11a_2$) and further, after the second impingement drying unit ($11a_2$), into the first group (R_1) of drying cylinders in the dryer section (K).

30

12. An equipment as claimed in any of the preceding claims, **characterized** in that the last press nip (V) is a so-called equalizing press with no felt.

13. A method in the transfer of a web (W) in connection with a paper or board machine, **characterized** in that the web (W) is transferred on the face of a transfer belt (H_{100}), that the web (W) is passed on the face of the transfer belt (H_{100}), being affixed to the belt face by means of adhesion, from the last press ($10a_1, 10a_2$ or $10a_1, S_{100}$) in the press section (P) so that the transfer belt (H_{100}) is in contact with a press roll ($10a_1$ or S_{100}) of the last press.

14. A method as claimed in claim 13 in the transfer of a web in connection with a paper or board machine, **characterized** in that the web (W) is passed, while meandering in loop shape and while adhering to the face of a transfer belt (H_{100}), from a drying cylinder (K_1) in the group (R_I) of drying cylinders in the dryer section (K) onto a reversing roll (E_1) and further from the reversing roll onto the next drying cylinder (K_2) and further in the group (R_I) of drying cylinders.

15. A method as claimed in the preceding claim in the transfer of a web in connection with a paper/board machine, **characterized** in that the transfer belt (H_{100}) has been passed as a closed loop, besides over the drying cylinders ($K_1, K_2 \dots$) and the reversing rolls ($E_1, E_2 \dots$) in the group (R_I) of drying cylinders in the dryer section (K), also through the press nip (N_1) in the last press (P_N) in the press section (P).

16. A method as claimed in any of the preceding claims in the transfer of a web in connection with a paper/board machine, **characterized** in that, in the invention, the drying capacity is increased by passing a heat transfer medium, such as steam, warm air or gas, into connection with the web (W) through an impingement drying unit ($11a_1, 11a_2 \dots$), which impingement drying unit has been fitted in connection with a reversing roll/rolls ($E_1, E_2 \dots$).

17. A method as claimed in any of the preceding claims in the transfer of a web in connection with a paper/board machine, **characterized** in that, in the method, the web (W) is transferred in such a drying group (R_I) in the dryer section (K) as comprises a transfer belt (H_{100}) and in which group (R_I) of drying cylinders suction rolls have been substituted for by conventional reversing rolls ($E_1, E_2 \dots$) which are

provided with a smooth non-perforated face (e), and that after this the web is transferred into a conventional group (R_{II}) of drying cylinders provided with single-wire draw in the dryer section (K), in which group the web is passed, while meandering in loop shape, from a drying cylinder (K_1) onto a suction roll (S_1) and
5 from the suction roll (S_1) onto a second drying cylinder (K_2) and further in said second group (R_{II}) of drying cylinders, in which second group (R_{II}) of drying cylinders suction rolls are employed as reversing cylinders.

18. A method as claimed in any of the preceding claims in the transfer of a web in
10 connection with a paper/board machine, **characterized** in that, in the first group (R_I) of drying cylinders, the web (W) is transferred as a closed loop over drying cylinders (K_1, K_2, \dots), which are preferably steam-heated drying cylinders, and over reversing rolls (E_1, E_2, \dots) and additionally through the press nip (N_1) of a press (P_N), which press (P_N) is preferably an extended-nip press.

19. A method as claimed in claim 13 in the transfer of a web in connection with a paper/board machine, **characterized** in that the web is passed from the last press in the press section (P), while adhering to a transfer belt (H_{100}), which transfer belt (H_{100}) has been passed as a closed loop through the press nip (N_1), and that the web
20 is passed along with the transfer belt (H_{100}) over a roll (100) with a large diameter, which roll comprises, in its connection, at least one impingement drying unit ($11a_1, 11a_2, \dots$), through which a drying medium, such as warm air or steam, is passed into connection with the web (W) to be dried, and that, from the roll (100) which is provided with an impingement drying unit/units in its connection the web is passed
25 further into the first drying group (R_I) in the dryer section (K).

20. A method as claimed in claim 13 in the transfer of a web in connection with a paper/board machine, **characterized** in that, in the method, the web is passed from the last press ($10a_1, 10a_2$) in the press section along with the transfer belt (H_{100})
30 along a linear run (D_1) of the transfer belt, in connection with which linear run (D_1) there are support rolls ($120a_1, 120a_2, \dots$) and, at the opposite side of the run (D_1), there is an impingement drying unit ($11a_1$), which is a construction that comprises

an oblong hood (110), through which construction a heating medium, such as warm air or steam, is passed into connection with the web (W) in order to dry the web, and that, after the impingement drying unit, the web (W) is passed from the transfer belt into the first group (R_I) of drying cylinders in the dryer section (K).

5

21. A method as claimed in claim 13 in the transfer of a web in connection with a paper or board machine, characterized in that, in the method, the web is passed, while adhering to the face of the transfer belt (H_{100}), from the last press ($10a_1, 10a_2$) of the press section (P) so that the web (W) is first made to run vertically along the transfer belt (H_{100}) supported by support rolls ($120a_1, 120a_2 \dots$) upwards, in which connection, in connection with said vertical run, there is a first impingement drying unit ($11a_1$), and that the web is made to run from the last support roll along the faces of the support rolls ($120a_n, 120a_{n-1} \dots$) along with the transfer belt (H_{100}) that is passed downwards, in connection with which downward run there is a second impingement drying unit ($11a_2$), and that the web (W) is passed after the second impingement drying unit ($11a_2$) from the transfer belt (H_{100}) into the first group (R_I) of drying cylinders in the dryer section (K).

10

15

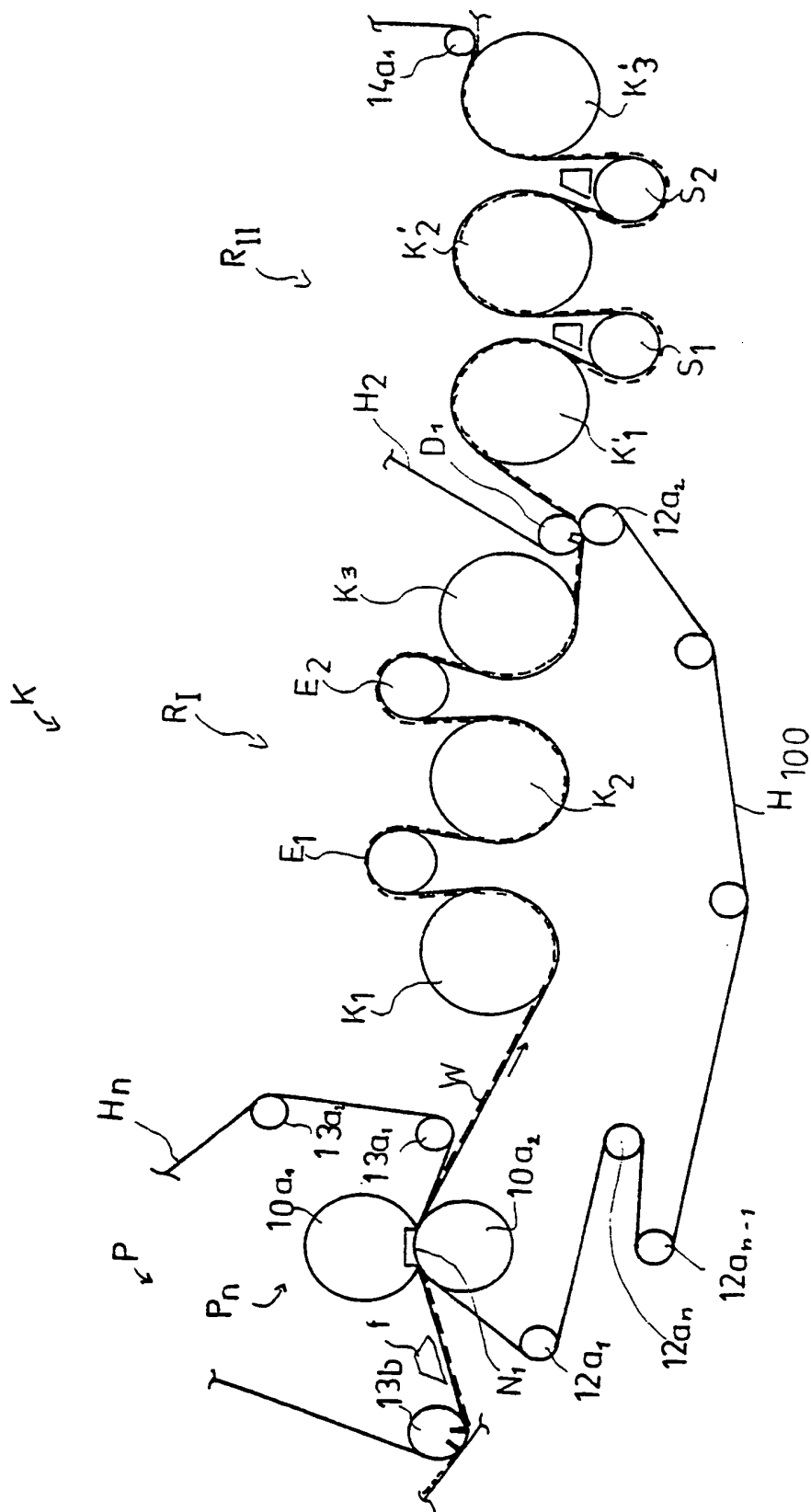


FIG. 1

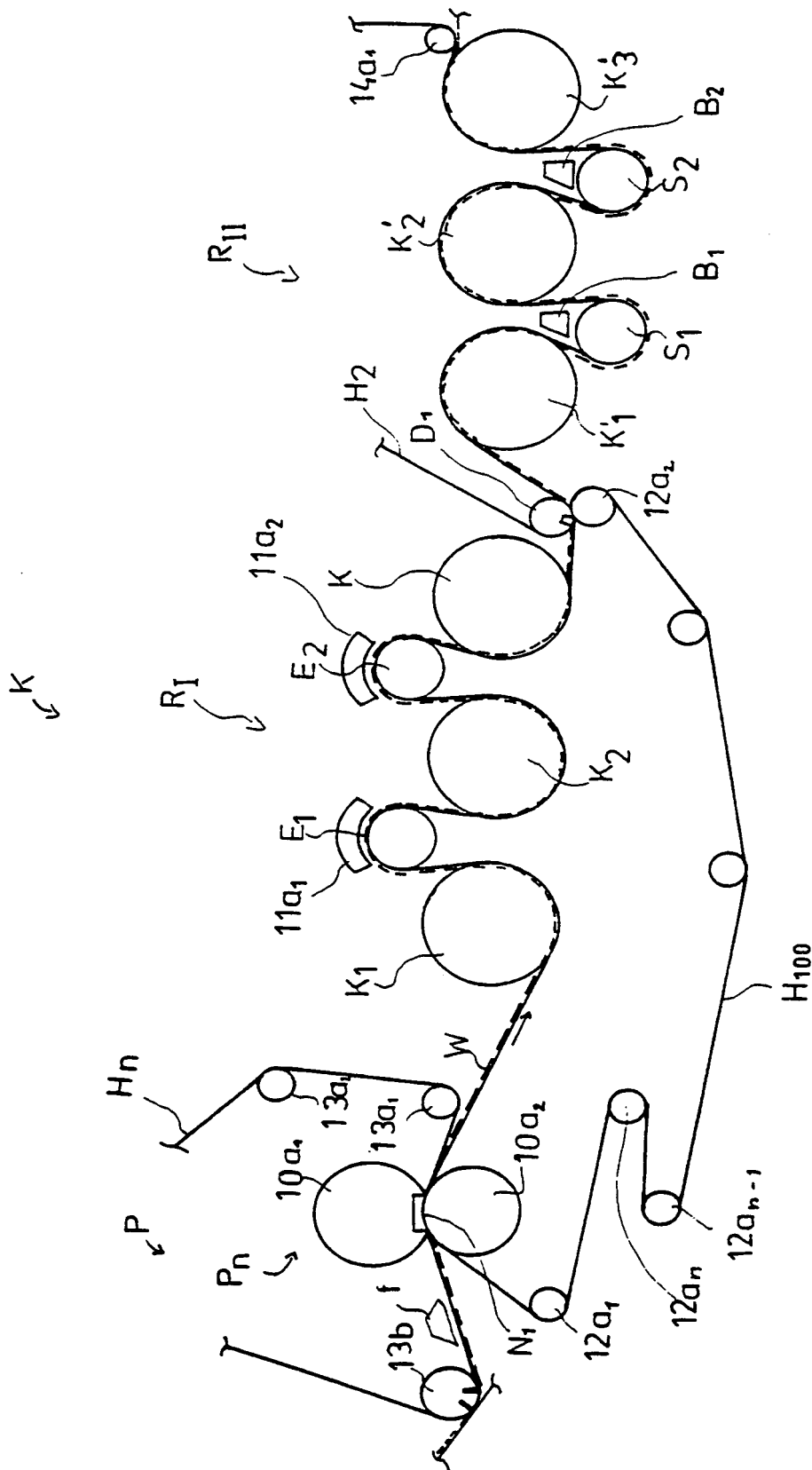


FIG. 2



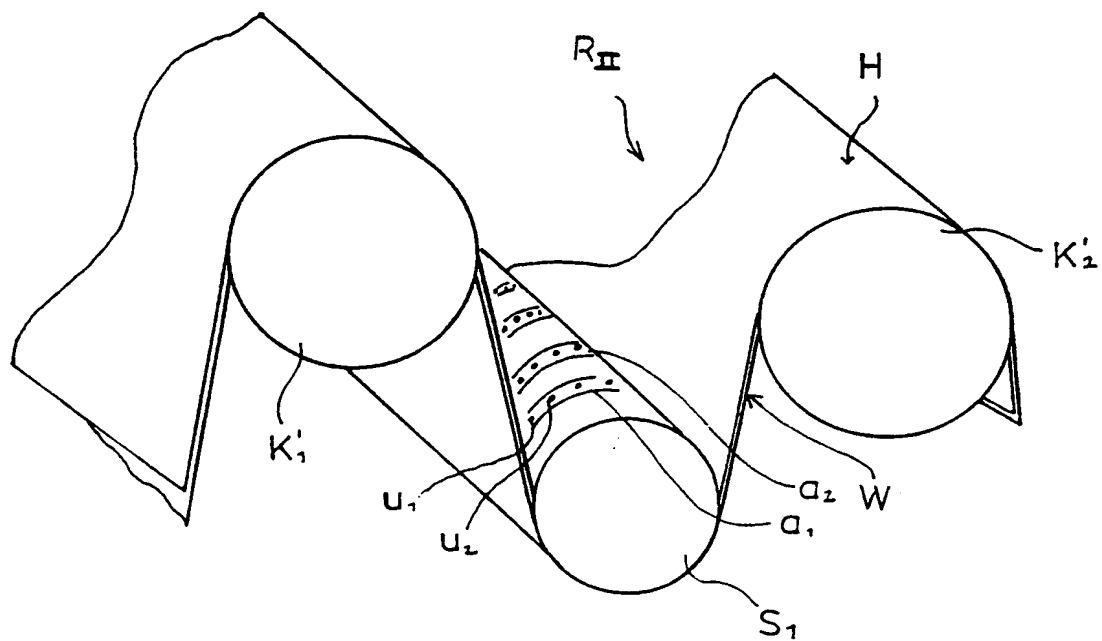


FIG. 3A

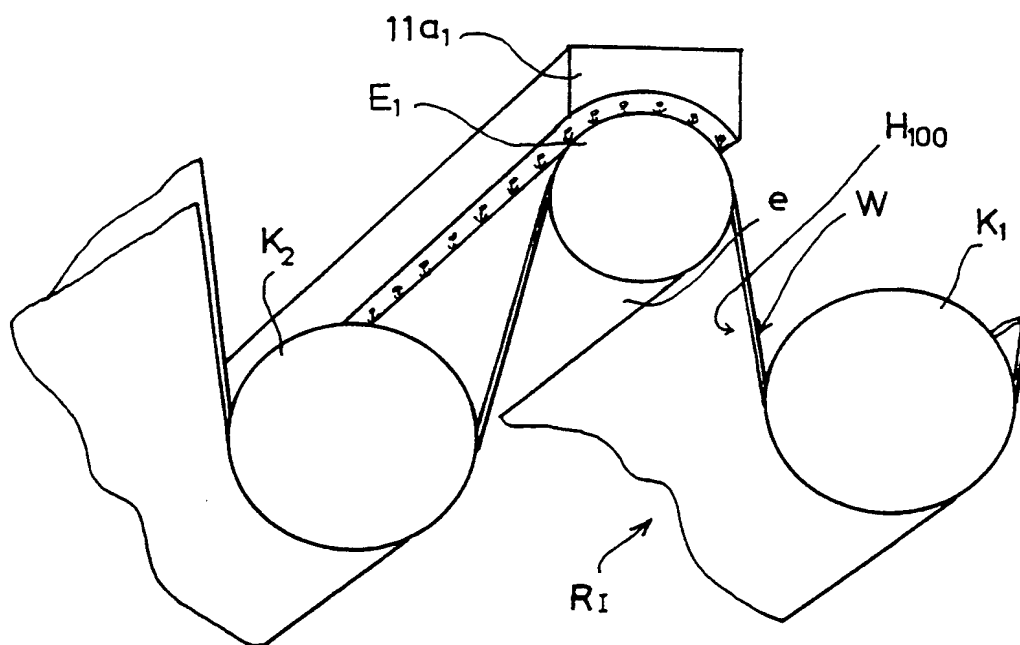


FIG. 3B



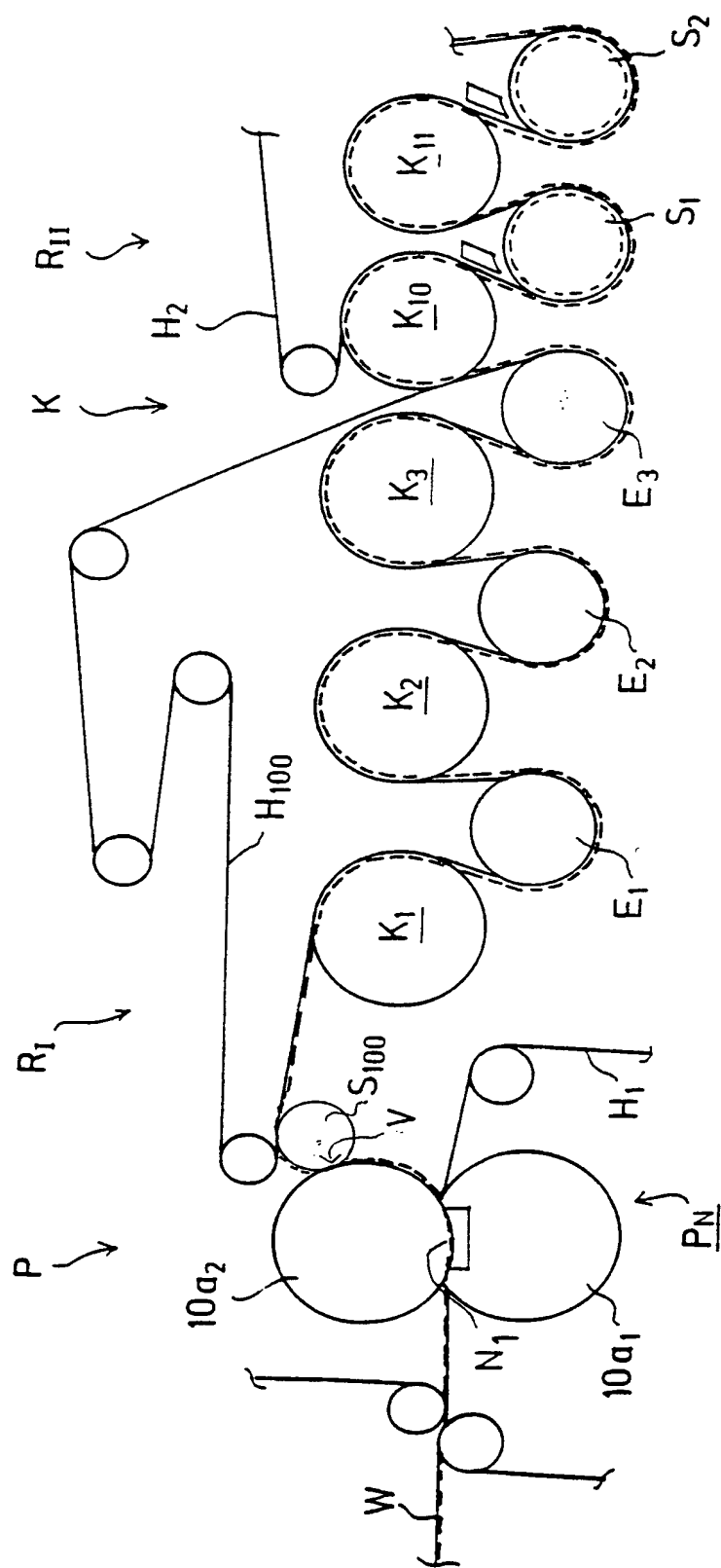


FIG. 4



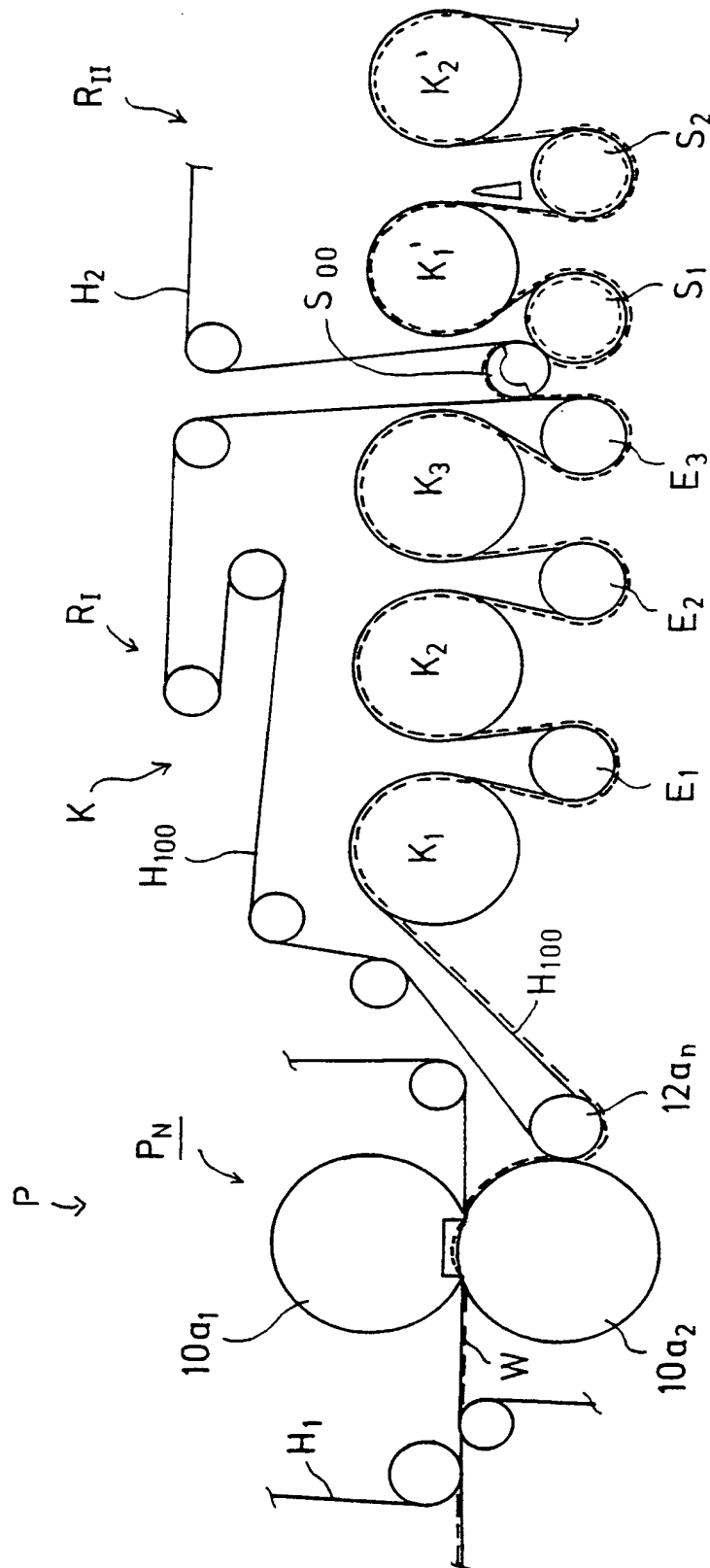


FIG. 5



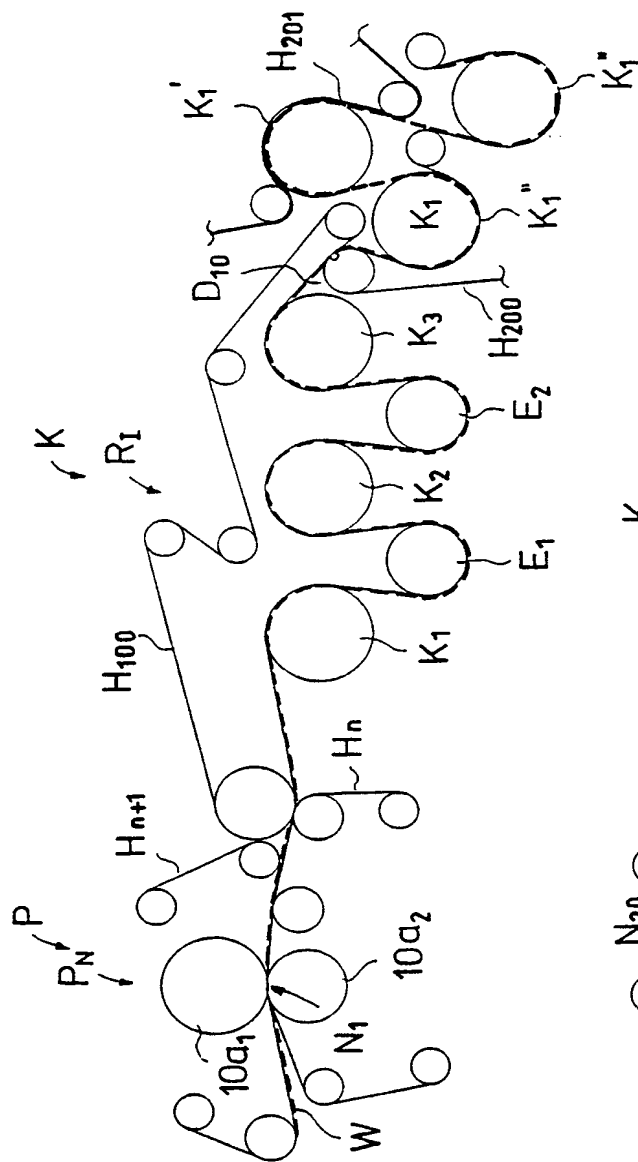


FIG. 6A

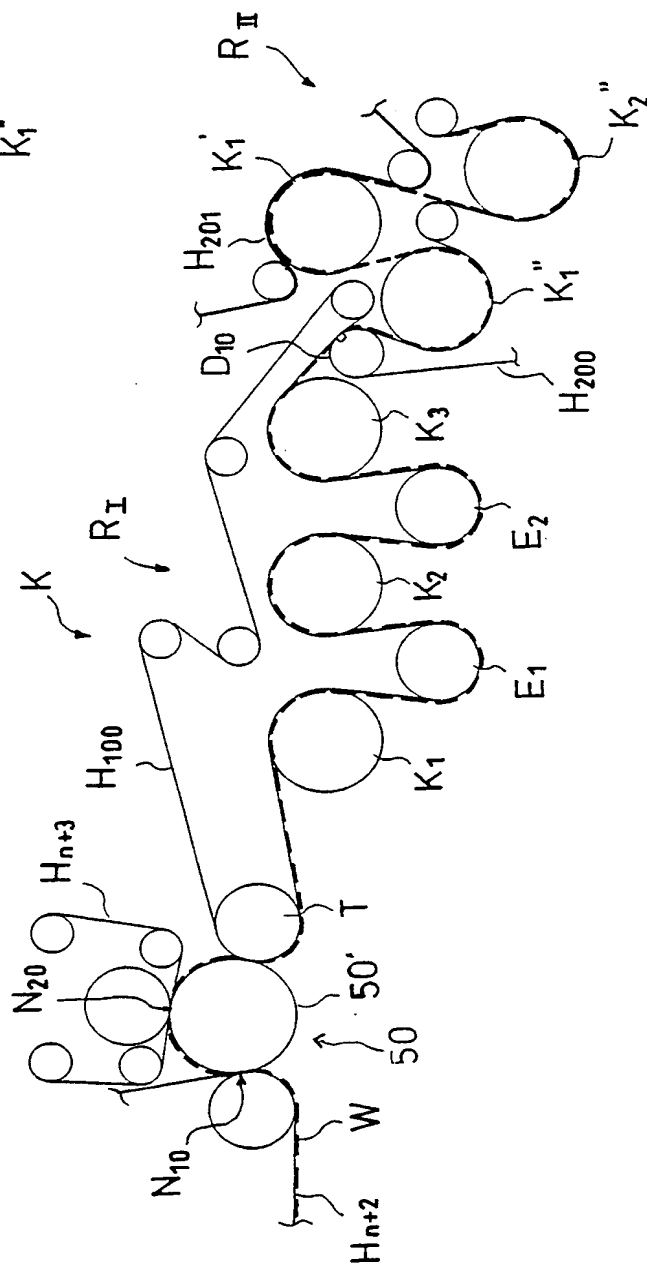


FIG. 6B

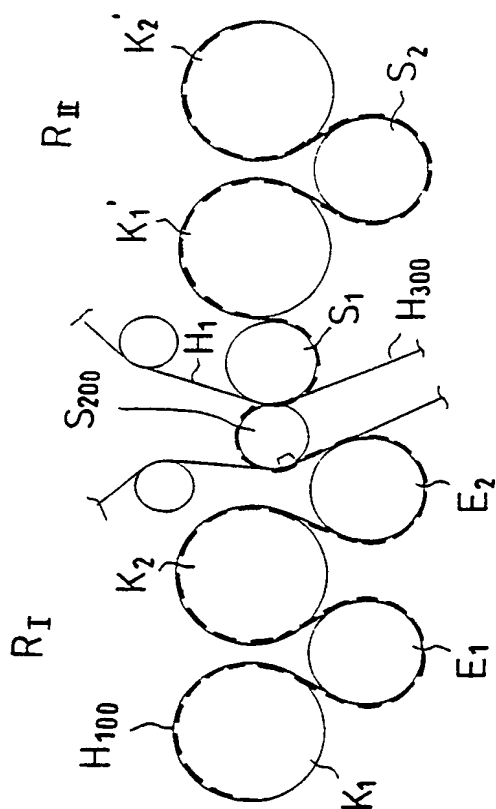


FIG. 7A

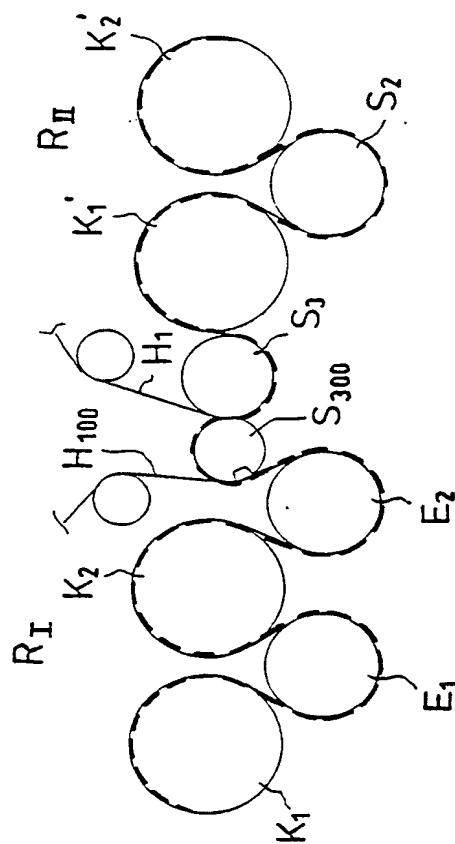


FIG. 7B

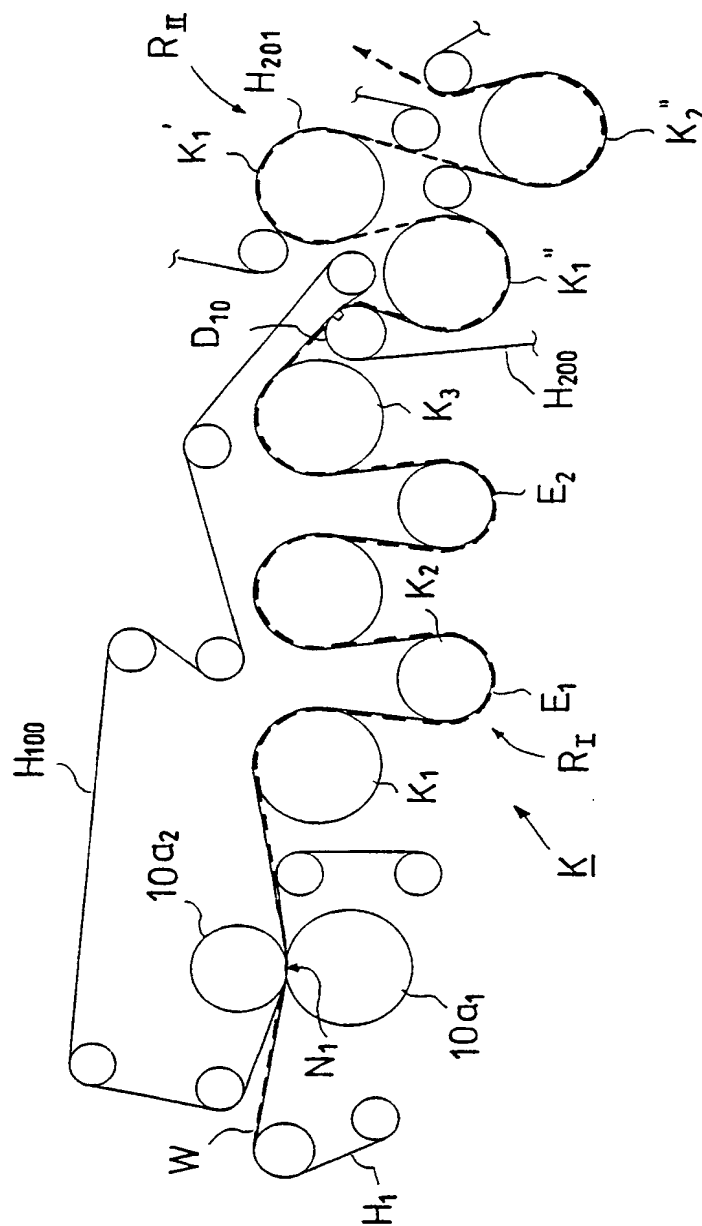
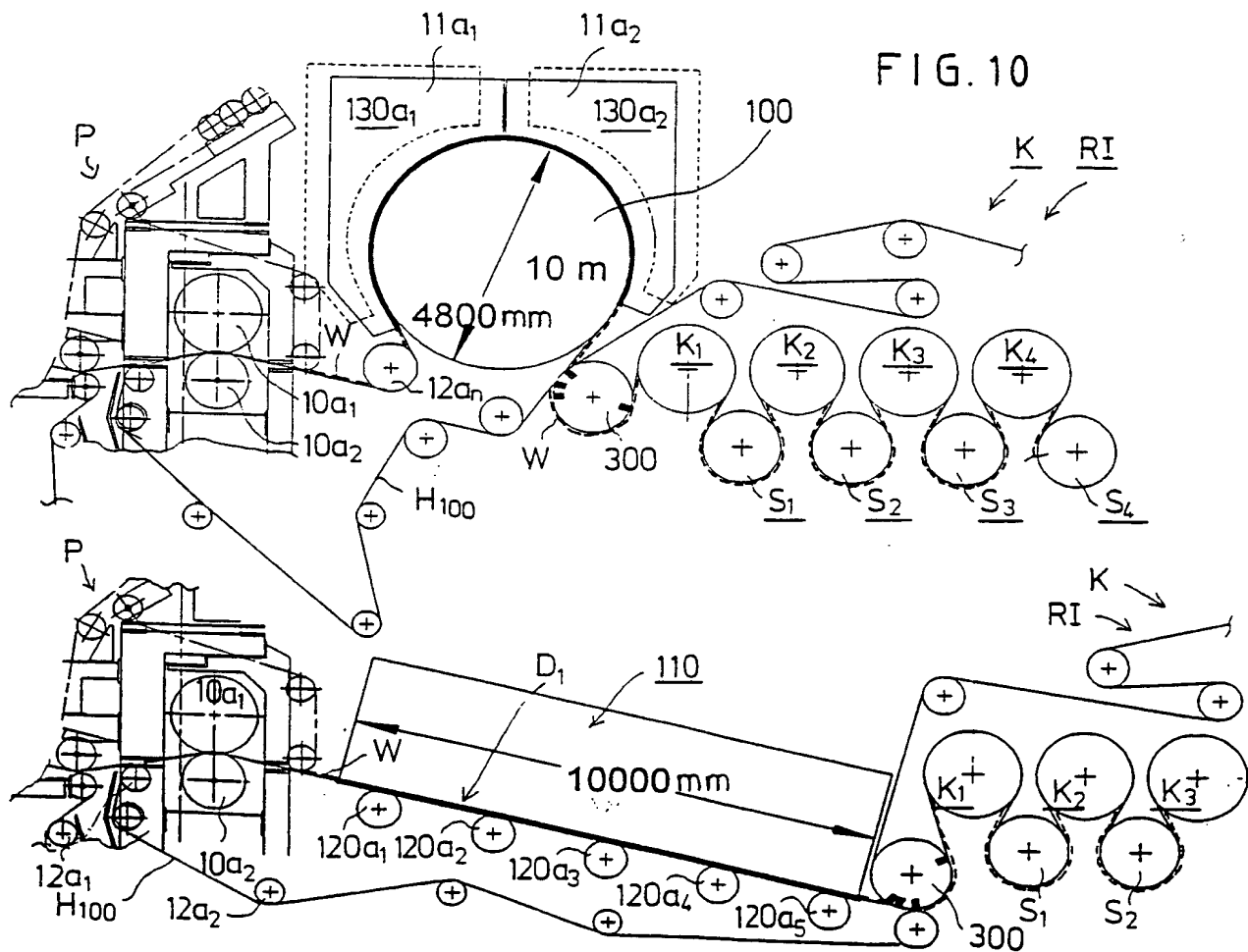
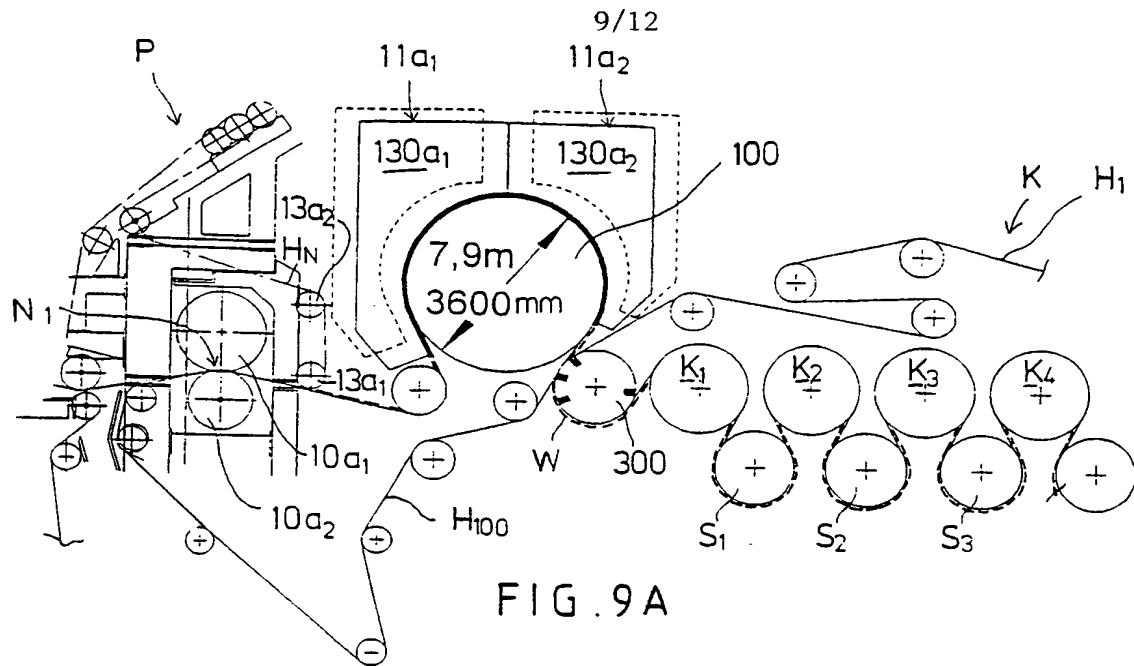


FIG. 8





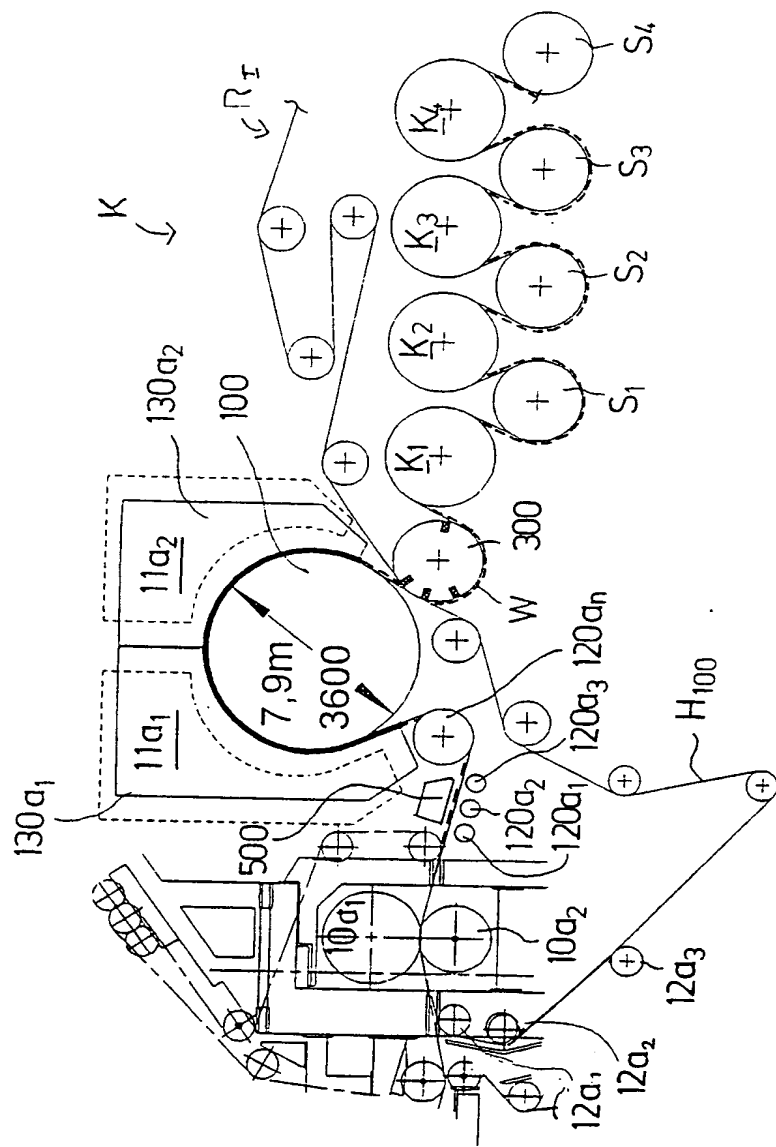


FIG. 9B



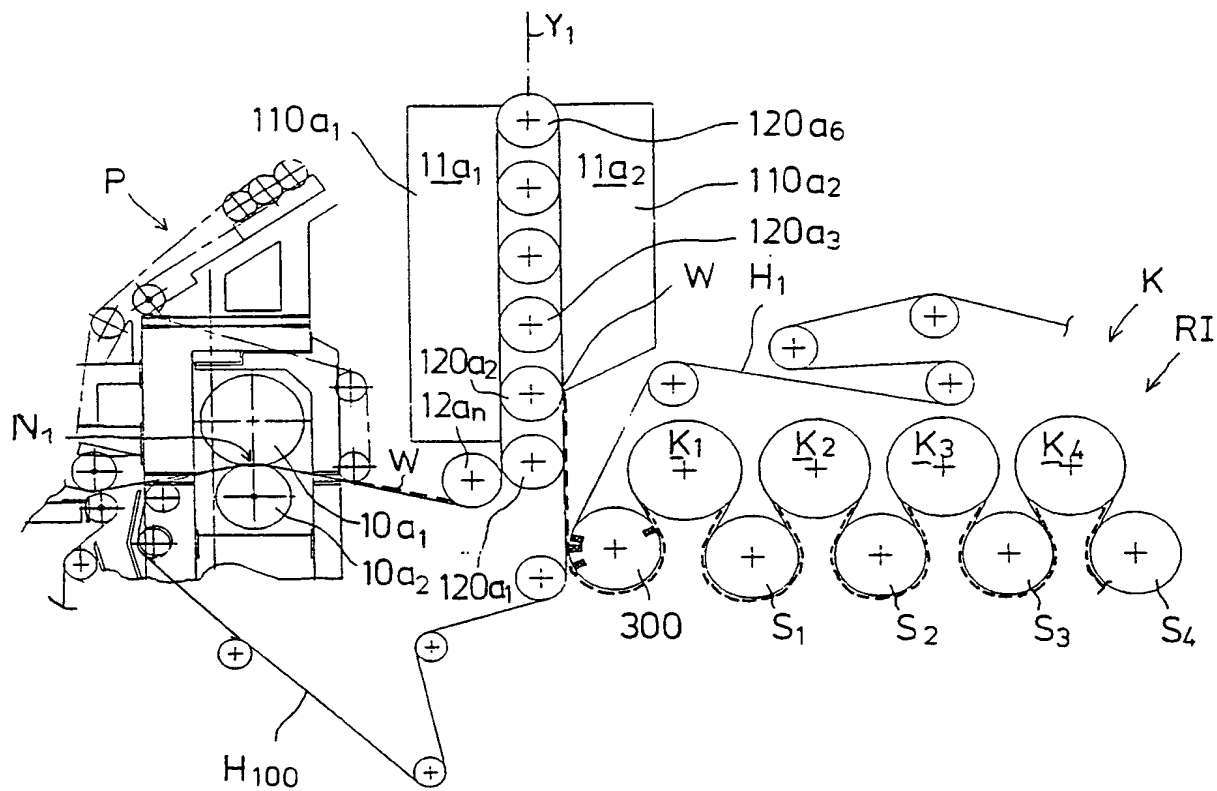


FIG. 12



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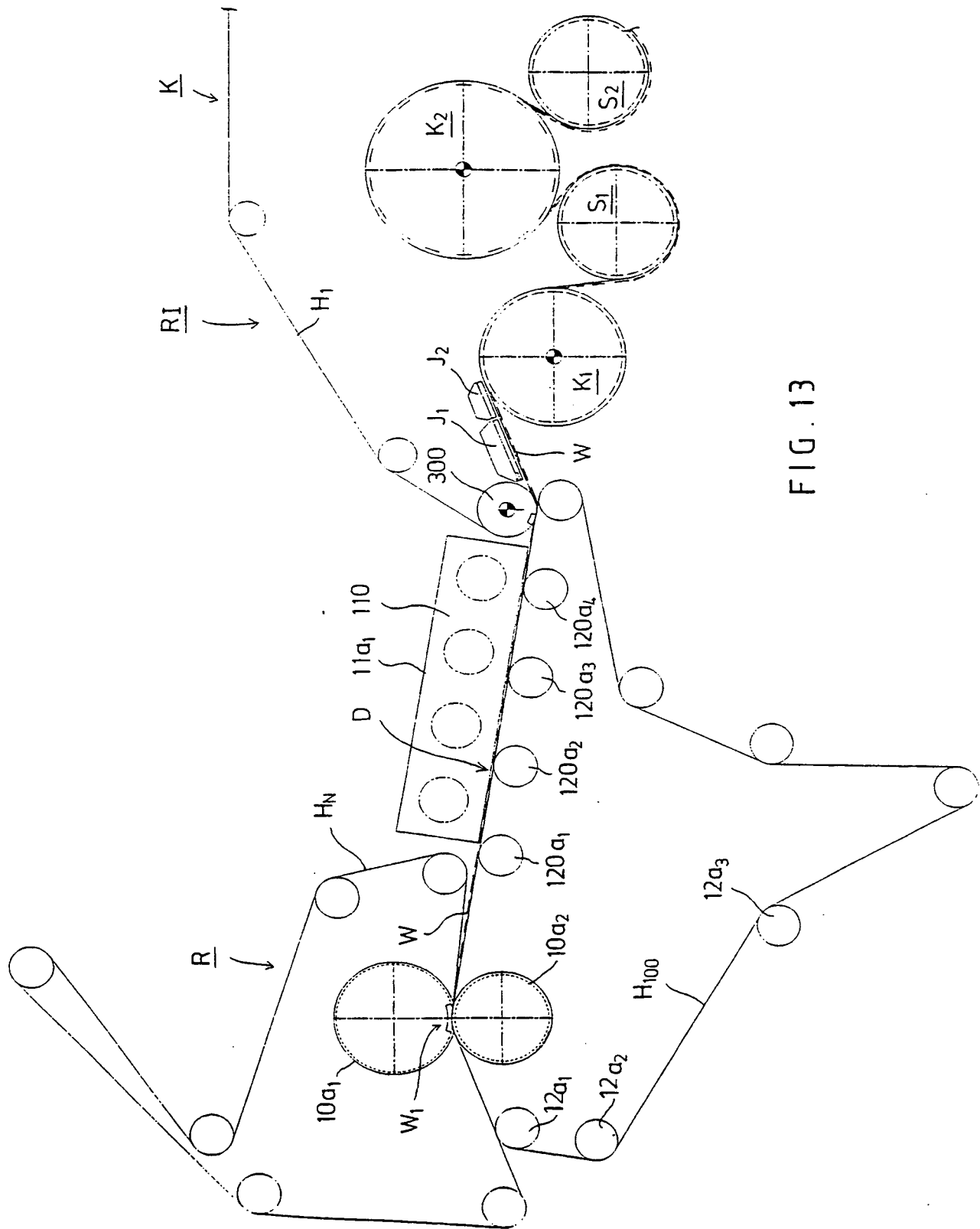


FIG. 13



INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 98/00446

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: D21F 3/00, D21F 7/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: D21F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 9714846 A1 (SCAPA GROUP PLC), 24 April 1997 (24.04.97) --	1,13
A	US 5397438 A (PETRI NYBERG ET AL), 14 March 1995 (14.03.95) --	1,13
A	US 5298124 A (NILS O. EKLUND ET AL), 29 March 1994 (29.03.94) -- -----	1,13

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

17 Sept 1998

Date of mailing of the international search report

18-09-1998

Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT
Information on patent family members

27/07/98

International application No.

PCT/FI 98/00446

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